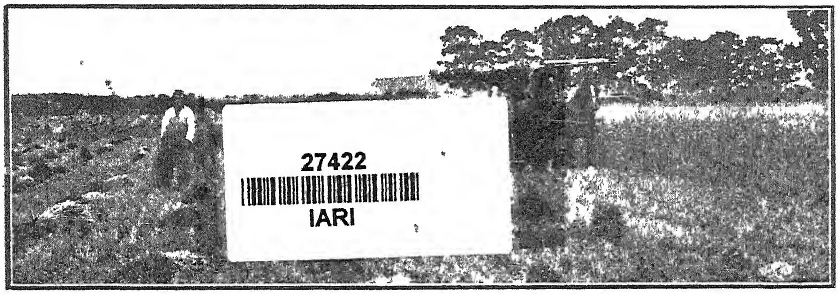


The New Zealand

Journal of Agriculture.

VOL. XXVI.—NO. 1.

WELLINGTON, 20TH JANUARY, 1923.

THE BRACKEN-FERNS OF NEW ZEALAND.

I. A COMPARATIVE ACCOUNT OF THE SPECIES.

ESMOND ATKINSON Biological Laboratory, Wellington.

THE vast majority of the weeds of New Zealand consist of plants which man, intentionally or unintentionally, has brought from other countries, Europe being by far the largest contributor to the list. There are, however, a few indigenous plants, most of them originally occupying comparatively unimportant positions in the vegetation, which, with the spread of settlement, have greatly increased in abundance, and which must now be included among the most aggressive enemies of the farmer. Striking examples of such plants are the various kinds of hutiwai, or piripiri (*Acaena*), and the three ferns which are described in this article.

A good deal has been written about the common fern, which is the species of most economic importance, the outstanding contribution to the subject being A. H. Cockayne's " [illegible]version of Fernland into Grass" (*Journal*, Vol. xii, p. 421), in [illegible] whole question of the replacement of fern by useful associatio[illegible] [illegible]into exhaustively. The object of the present article is to give a comparative account of those species of what may be called bracken-ferns, which, by their

power of establishing and maintaining themselves in grassland, must be ranked as weeds. It is intended in a future article to describe the control methods which experience has shown to be most successful in dealing with these weeds, particularly in regard to those species about which little has been written.

There are, broadly speaking, six species of bracken-ferns indigenous in New Zealand, all of which were originally included by botanists in the genus *Pteris*. For various technical reasons certain of them have been removed from the original genus, and the six species now bear the following names:—

Common bracken-fern (*Pteridium esculentum* (Forst. f.) Cockayne).
Hard fern (*Paesia scaberula* (A. Rich.) Kuhn).
Water-fern (*Histiopteris incisa* (Thunb.) J. Sm.).
Scented fern (*Pteris tremula* R. Br.).
Pteris comans Forst. f.
Pteris macilenta A. Rich.

The last three species will not be fully described here; it will be enough to indicate how they differ from the others, since they can hardly be considered of economic importance. The scented fern is intermediate in appearance between the common fern and the water-fern, but is most like the latter, from which it is readily enough distinguished at sight by the narrower divisions of the frond, and especially by the short tufted rhizome or underground stem, which is quite unlike the long creeping one of the water-fern. The scented fern belongs naturally to the outskirts of the bush, or to such places within it as are well lighted; it may often be seen now covering large areas in warm sheltered gullies, but it shows little tendency to establish itself on grassland. *Pteris comans* and *Pteris macilenta*, which have no generally accepted common names, but which might appropriately be called "bush bracken-ferns," appear to be more dependent on shade than the other New Zealand brackens, so that their distribution is practically determined by the presence or absence of forest, which renders them negligible as weeds. They agree with scented fern in possessing short tufted (not creeping) rhizomes, so that they are not likely to be confused with the water-fern, which they otherwise slightly resemble. The exclusive possession of widely creeping underground stems (clearly shown in the accompanying drawings) by the three species of economic importance is a significant fact to which reference will be made later.

THE MODE OF REPRODUCTION OF FERNS.

The mode of reproduction of ferns differs widely from that of all flowering-plants, and, apart from its having considerable practical bearing, is interesting enough on its own account to be described briefly here. The fern-plant possesses no sexual organs, but depends for its reproduction on spores, which are one-celled bodies of microscopic size borne in large numbers in sporangia, or spore-cases, which themselves are closely massed in groups called "sori" on the under-surface of the frond. The sori vary greatly in appearance and structure in the different kinds of ferns; in the three here described they lie near the margin of the frond, and are protected by its recurved edge (see drawings). The spores when ripe are scattered

FIG. 1. COMMON BRACKEN-FERN GROWING WITH TUTU.

FIG. 2. HARD FERN.

[Photos by E. Bruce Levy.

by the wind, fall to the ground, and germinate. Instead of giving rise to a fern-plant like the parent one, each germinating spore produces a very small green, generally flattened, and more or less heart-shaped plant called a "prothallus." On the under-surface of the prothallus are borne the sexual organs. The male cells are capable of independent motion by means of minute waving threads called "cilia." In the presence of moisture—which is an essential—they are able to pass from the receptacle in which they are borne and enter the female organ, where a single one fuses with the female cell, or ovum. From the fertilized ovum there is developed an embryo, which grows into a conspicuous spore-bearing fern-plant like that first described.

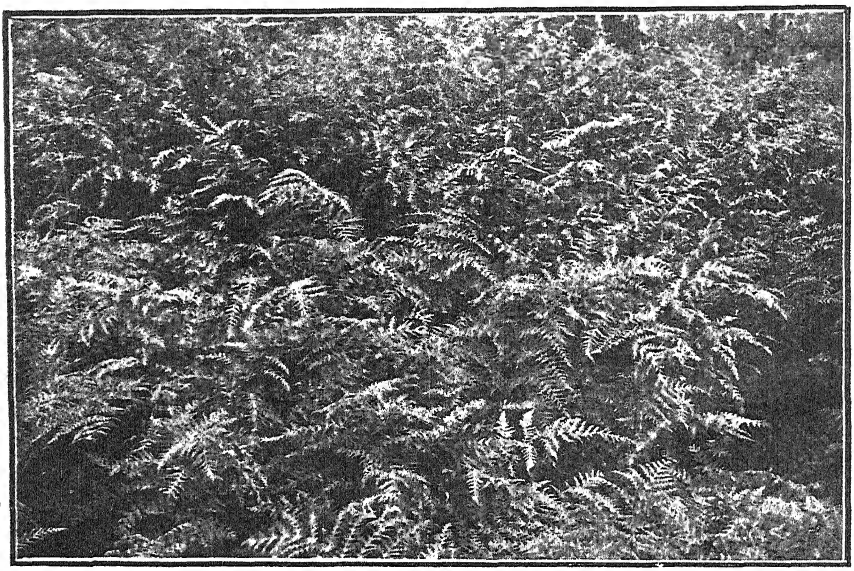


FIG. 3. WATER-FERN AT EDGE OF BUSH.

[*Photo by E. Bruce Levy.*

This occurrence of regularly alternating sexual and asexual generations, which is known simply as the "alternation of generations," is a phenomenon not by any means confined to the ferns and their near allies, though it is particularly easy to observe in them. Their production of spores, which can be borne for immense distances by the wind, accounts for the ferns being among the very first plants to colonize an area that has by any means—such as volcanic action—become denuded of vegetation, and for the fact that many species, of which the common fern is a very good example, are almost cosmopolitan in their distribution.

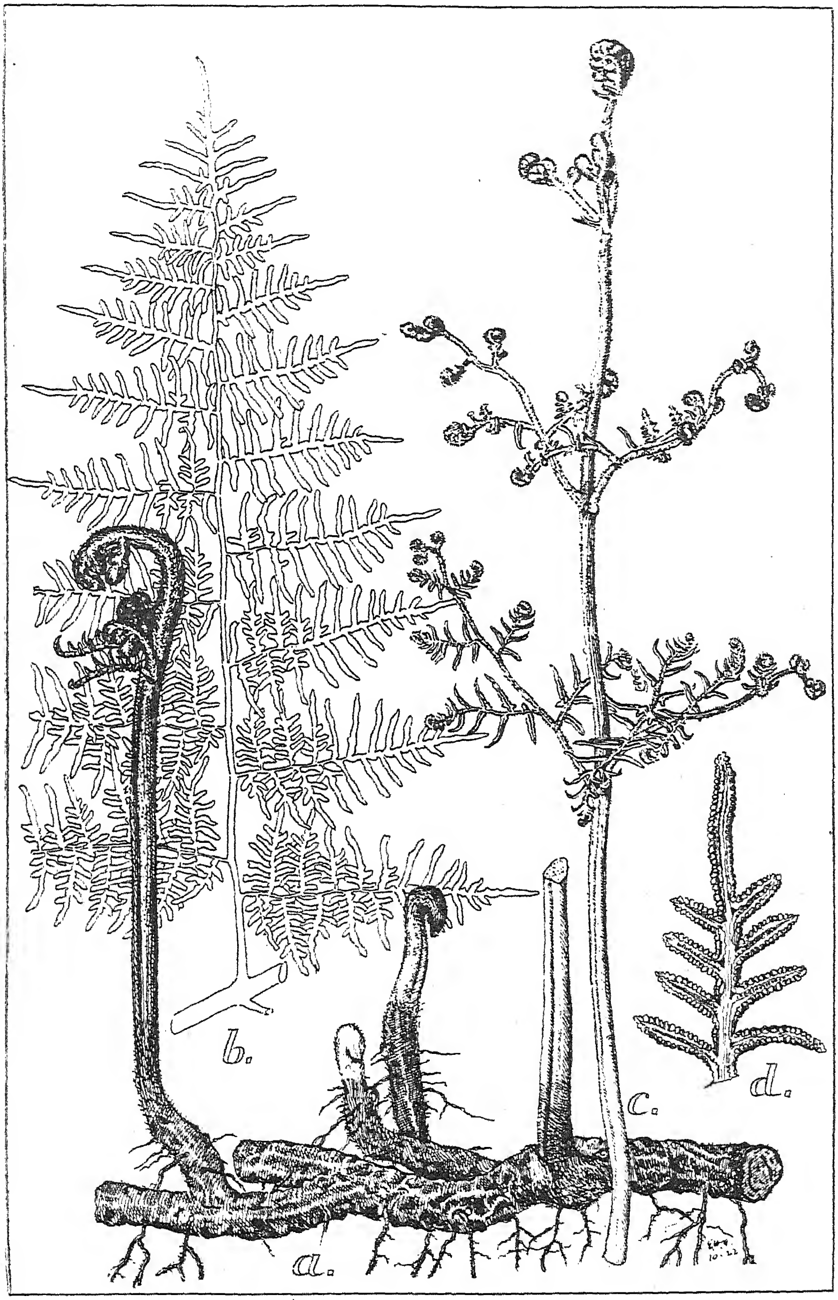


FIG. 4. COMMON BRACKEN-FERN (PTERIDIUM ESCULENTUM).

(*a*) Rhizome, with young fronds in curl stage; (*b*) part of mature frond; (*c*) young frond (later stage than those in (*a*)); (*d*) small part of mature frond seen [illegible] and (*c*) half natural size; (*d*) enlarged. Original.

by the wind, fall to the ground, and germinate. Instead of giving rise to a fern-plant like the parent one, each germinating spore produces a very small, green, generally flattened, and more or less heart-shaped plant called a "prothallus." On the under-surface of the prothallus are borne the sexual organs. The male cells are capable of independent motion by means of minute waving threads called "cilia." In the presence of moisture—which is an essential—they are able to pass from the receptacle in which they are borne and enter the female organ, where a single one fuses with the female cell, or ovum. From the fertilized ovum there is developed an embryo, which grows into a conspicuous spore-bearing fern-plant like that first described.

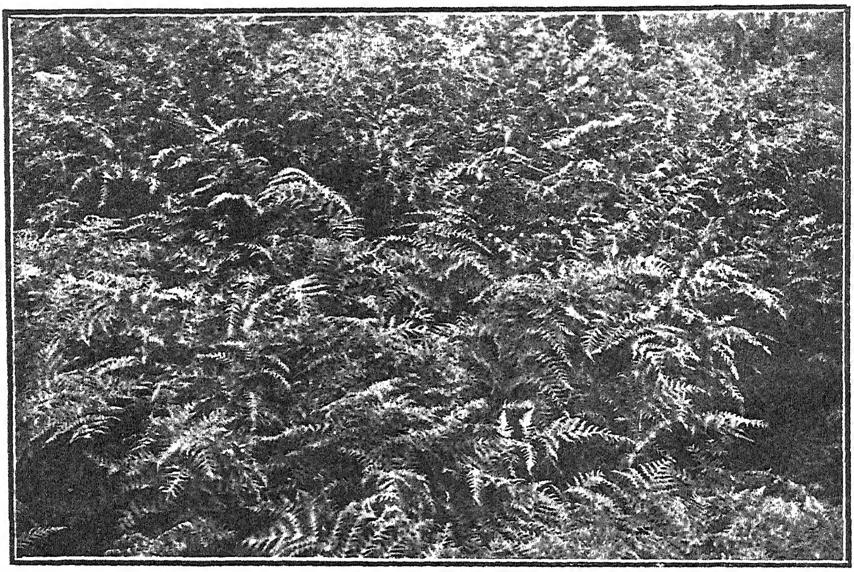


FIG. 3. WATER-FERN AT EDGE OF BUSH.

[*Photo by E. Bruce Levy.*

This occurrence of regularly alternating sexual and asexual generations, which is known simply as the "alternation of generations," is a phenomenon not by any means confined to the ferns and their near allies, though it is particularly easy to observe in them. Their production of spores, which can be borne for immense distances by the wind, accounts for the ferns being among the very first plants to colonize an area that has by any means—such as volcanic action—become denuded of vegetation, and for the fact that many species, of which the common fern is a very good example, are almost cosmopolitan in their distribution.

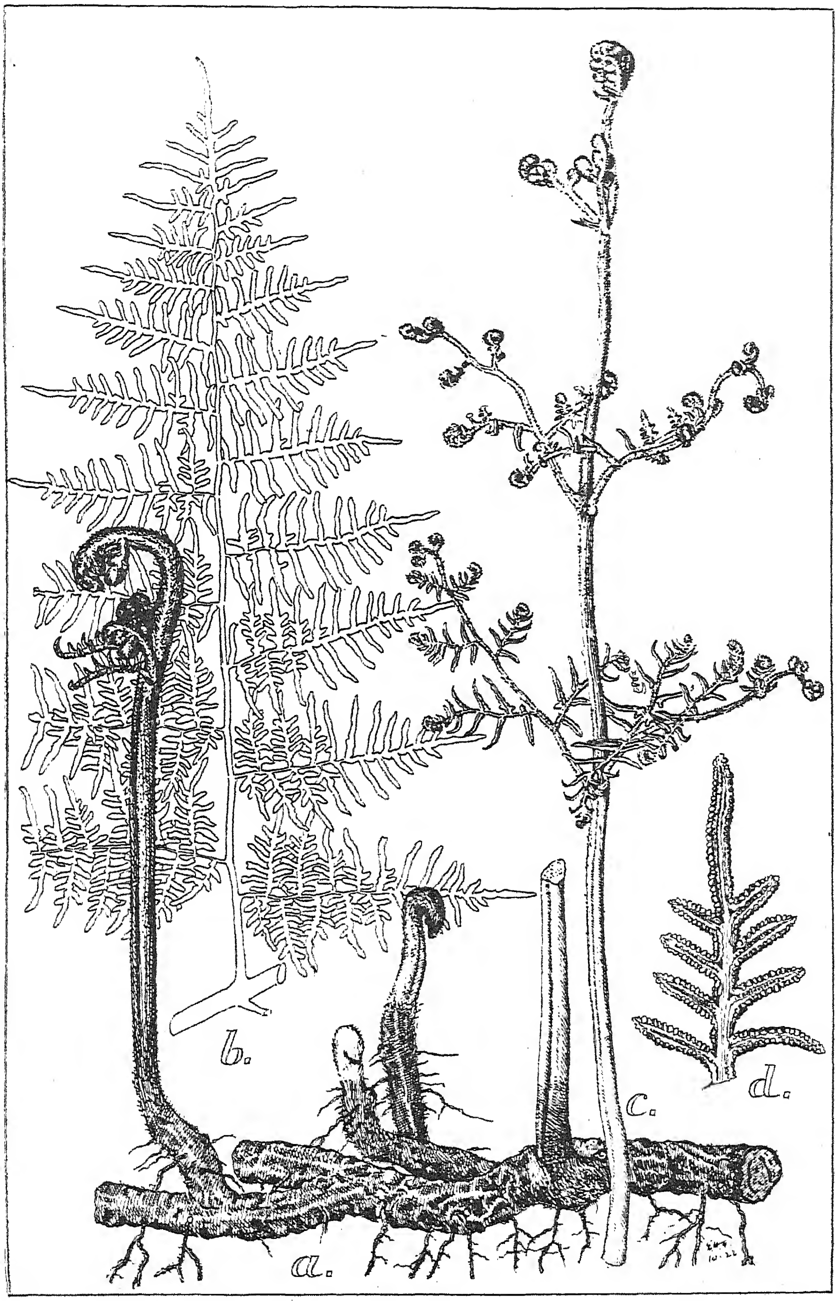


FIG. 4. COMMON BRACKEN-FERN (PTERIDIUM ESCULENTUM).

(*a*) Rhizome, with young fronds in curl stage; (*b*) part of mature frond; (*c*) young frond (later stage than those in (*a*)); (*d*) small part of mature frond seen from below, showing sori. (*a*), (*b*), and (*c*) half natural size; (*d*) enlarged. Original.

Many ferns, including the three described in this article, have a growth-form characterized by a more or less subterranean, horizontally-spreading stem or rhizome, which enables a single plant in a short time to cover a large space. When an area favourable to their development, such as a recent burn, is left open to invasion by the bracken-ferns, such invasion takes place in two stages, distinct enough in reality, though not always easy to recognize: first, the sowing of wind-borne spores more or less evenly over the ground, with the production of prothalli wherever the conditions are suitable*; secondly, the spreading outwards of the fern-plants from these points of infestation by means of their rhizomes. In time these fern-plants will themselves produce spores which may give rise to a fresh crop of prothalli. After the first invasion, however, the prothalli probably play a secondary part in securing the dominance of the ground by the fern, its tremendous vegetative development, which often results in the formation of a network of "fern-roots" below the surface of the soil, completely eclipsing the comparatively slow production of young plants from prothalli.

DESCRIPTION OF THE SPECIES.

The descriptions which follow are arranged in a more or less tabular form in order that the three species may be readily compared, the key which precedes these descriptions being intended to show at a glance the essential differences in general appearance between the three plants. To serve as a basis for comparison the common fern, which might be considered too well known to need description, is included.

Frond (except when young) more or less dry and hard in texture; final divisions narrow:—

Frond brownish or dull green, 2 ft. to 8 ft. or more long, *Pteridium esculentum.*

Frond pale green, 6 in. to 18 in. long, very finely cut, *Paesia scaberula.*

Frond in all stages more or less soft, bluish-green; final divisions broad and blunt, *Histiopteris incisa.*

Common Fern, or Bracken (Pteridium esculentum (*Forst.* f.) *Cockayne*).
Synonym: Pteris aquilina *L. var.* esculenta *Forst.* f.

Rhizome ("fern-root"): Subterranean, few to many inches below the surface; as thick as the finger; widely creeping, branching freely, and producing fronds at frequent intervals; smooth; dark in colour; very mucilaginous when broken; with many thread-like roots.

Stipe (or stalk of frond): Up to many feet in length and as thick as a pencil; at first thickly clothed with golden-brown hairs, afterwards smooth, hard, and shining.

Frond: At first, like the stalk, covered with golden-brown hairs, especially below, afterwards smooth and hard; dull green above, paler below; a few to many feet long; very many times divided, the final segments like the teeth of a comb.

* Hitherto all control methods have been directed against the fern-plant itself. When more is known of the conditions which determine the production of prothalli it should be possible to supplement the present methods with an attack on the fern at an earlier stage in its life-history. This side of the question will be dealt with in a future article.

FIG. 5. HARD FERN (PAESIA SCABERULA).

(*a*) Part of a rhizome bearing a fertile frond; (*b*) part of a rhizome bearing sterile fronds; (*c*) part of a frond seen from below, showing sori. (*a*) and (*b*) half natural size; (*c*) enlarged. Original.

Hard Fern (Paesia scaberula (*A. Rich.*) *Kuhn*). *Synonyms:* Pteris scaberula *A. Rich.; Silver-fern; Pig-fern.*

Rhizome: Near the surface, running over it where the ground is hard; slender, about $\frac{1}{10}$ in. thick; widely creeping, branching, and producing fronds at frequent intervals; covered with reddish-brown hairs, especially in the younger parts; dark in colour; hard and wiry except when young; with many thread-like roots.

Stipe (or stalk of frond): A few inches to a foot or so long, and $\frac{1}{12}$ in. thick; at first pale in colour and hairy, afterwards reddish-brown; hard, wiry, shining, but more or less rough to the touch.

Frond: At first with scattered reddish-brown hairs, afterwards smooth or slightly rough to the touch; rather pale yellowish-green in colour; up to about 18 in. in length; very many times divided, the final segments deeply cut and lace-like, particularly in the case of sterile fronds or sterile parts of the frond.

Water-fern (Histiopteris incisa (*Thunb.*) *J. Sm.*). *Synonyms:* Pteris incisa *Thunb.; Soft Fern.*

Rhizome: Growing nearer the surface than that of the common fern, often nearly on the surface; usually considerably more slender; widely creeping, branching, producing fronds at frequent intervals; irregularly clothed with dark scales or almost smooth; dark in colour; mucilaginous when broken, but not filled with starch like the rhizome of the common fern; roots many and threadlike.

Stipe (or stalk of frond): Up to many feet long; $\frac{1}{3}$ in. thick when young, with scattered scales which soon fall off; at first pale green in colour, with a bluish-white bloom on the surface; afterwards more slender, smooth, hard, and shining, and pale or chestnut brown.

Frond: Smooth at all stages; when young covered with a bluish-white bloom which later disappears; pale blue-green in colour; softer and thinner in texture than the other two species; veins conspicuous when the frond is held up to the light; a few to many feet in length; many times divided, the final segments comparatively broad and blunt.

It has not been thought necessary to describe the sori (or groups of spore-cases), as their arrangement in the different species is shown clearly enough in the drawings, and is difficult to describe in non-technical language. Such other features as are plainly shown in the illustrations are for the most part also omitted from the descriptions.

DISTRIBUTION.

The common fern is found throughout the Southern Hemisphere; in the Northern Hemisphere its place is taken by the closely allied *Pteridium aquilinum* (L.) Kuhn, the English brake or bracken. *Pteridium esculentum* is abundant throughout the New Zealand area, this including, besides the North and South Islands and Stewart Island, all the outlying groups from the Kermadec to the Auckland and Campbell Islands. It ascends in the North Island to about 4,000 ft. The area originally occupied by fern in New Zealand is a matter of speculation. It is an accepted fact that with the destruction of forest the area now covered by it is very much greater than when the country was first colonized, while the Maori traditions of great

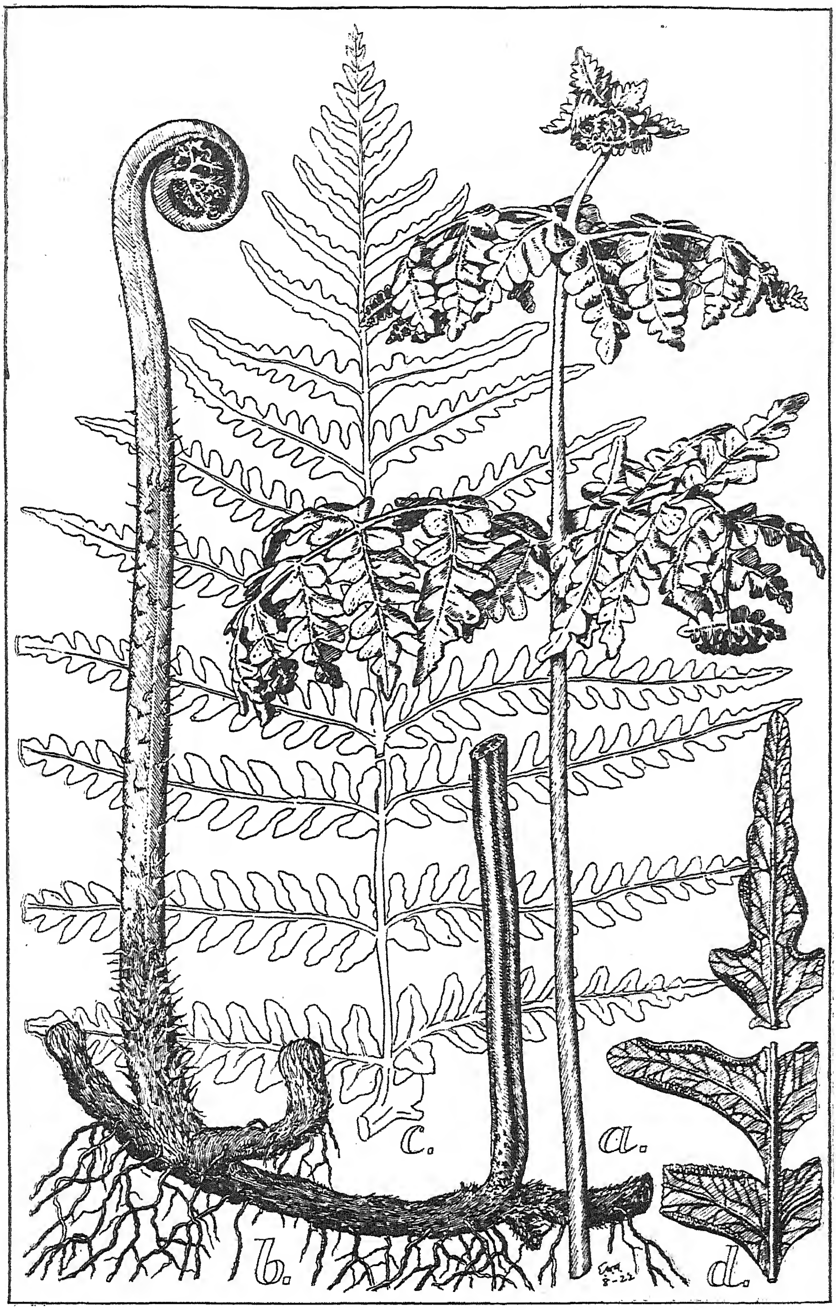


FIG. 6. WATER-FERN (HISTIOPTERIS INCISA).

(*a*) Young frond; (*b*) part of a rhizome with younger fronds than (*a*); (*c*) part of a mature frond; (*d*) small part of a mature frond seen from below, showing sori. (*a*), (*b*), and (*c*) half natural size; (*d*) enlarged. Original.

fires point to its having increased largely during their occupation of the land in pre-European days. It enters into almost every type of vegetation up to its altitudinal limit, dense forest being the main exception, though even there it will often appear where openings made by falling trees, &c., have let in the light. In such cases the fronds are softer in texture than usual, and the stalk supporting them is often greatly elongated and almost climbing, a length of 20 ft. being not uncommon.

The hard fern is abundant in many parts of the North and South Islands, Stewart Island, and the Chatham Islands, its altitudinal limit being about 2,500 ft. It is found nowhere else in the world. Hard fern originally occurred chiefly on the outskirts of dry forest, and on slips, banks, &c., especially in clay country, in all of which situations it may still be seen; but it has spread enormously along bush roads and cuttings, and, what is more to the point, has invaded much hilly grassland. In parts of the North Island it is looked upon as a worse weed than ordinary fern.

Water-fern is an abundant plant in suitable localities through the whole of the New Zealand area, while beyond it is found throughout the tropics and the South Temperate Zone. It is more dependent on damp conditions than the other two ferns, and may be seen in tropical luxuriance by the edges of hot springs. But it is not confined to such stations, being found in swamps, the outskirts of bush, and even on fairly dry ridges. Its altitudinal range is from sea-level to 3,000 ft.

(To be continued.)

PERIODS OF OCCURRENCE OF ABORTION IN CATTLE.

THE following tabulated information regarding contagious abortion among cattle in New Zealand, showing the period of pregnancy and the approximate age at which abortion occurred, has been prepared from reports furnished by the Department's Inspectors of Stock, based on twelve months' observation :—

Month of Pregnancy.	Percentage of Cases of Abortion.	Age of Animal affected.	Percentage.
First	Nil.	First calf	21
Second	0·3	Second calf.. ..	33
Third	0·9	Third calf	21
Fourth	1·8	Fourth calf.. ..	15
Fifth	8·0	Fifth calf	6
Sixth	17·0	Sixth calf	2
Seventh	55·0	Seventh calf ..	2
Eighth	17·0		

—*Live-stock Division.*

THE CULL COW AND ITS DISPOSAL.

A. R. YOUNG, M.R.C.V.S., Director of the Live-stock Division.

THE subject of the proper disposal of all cull cows, in such a manner as to prevent their being resold for dairying purposes, has been before the farming community for a considerable time without any definite solution of the problem being arrived at. The fact that it is just as important, and more economical, to prevent the necessity for culling as it is to find means for the disposal of such cows has suggested that it might assist if attention were drawn to the many and various causes contributing to make up this class of unprofitable animals.

Before discussing the disposal of cull cows it is necessary to point out that if legislation is to be enacted for this purpose a definite standard must be fixed as to what constitutes a cull. No progress can be made until this is decided, and it is a matter of some difficulty, for what one breeder who has been culling for years considers a cull cannot generally be accepted as a standard for the beginner, at least for some years to come. The matter of replacement is a serious consideration, as the first man's culls might be considered by the other to be as good as his own best. This position might be met by the formation of an "A" and a "B" grade, leaving "C" to represent culls. With a recognized first and second grade of milking-animals the position would be simplified, but would still leave sufficient dfficulties for serious consideration before a working scheme could be adopted which would promise a fair measure of success.

In considering some of the agencies which tend to bring about unfavourable conditions it must be recognized that the selection of milking strains will not by itself (although it is an important factor) be sufficient without co-operation in other directions, because, while many animals are fated from birth to be unprofitable, a very large number are not. These latter are afterwards made so by sheer bad management at some period or other of their existence, and not on account of any inherited anatomical or physiological disabilities. Therefore, although careful selection for milking propensities may have been made, it is still important that every precaution should be taken to look after the animal's welfare so as to prevent her from becoming unprofitable. This can be done only by educating the stockowner in the most up-to-date methods of stock-management suitable for the requirements of New Zealand conditions. Here is the weakest link in the whole chain of the dairy industry at the present time, and the matter should receive prompt attention if we are ever to attain a general improvement in quantity and quality of milk.

SOME RELATED FACTORS.

Many of the causes operating to make unprofitable cows could be prevented by the stockowners themselves if they would only recognize that proper stock-management is both interesting and profitable, and conducive not only to the health and comfort of the animals but

also to the owners' pleasure and that of every one connected with their establishments. It is recognized that a short article such as the present one cannot contribute much to the farmer's knowledge of stock-management, but if it merely arouses his interest in the subject the object of these notes will have been attained.

The Scrub Bull.

The use of a bull about whose history little or nothing is known is to be at once condemned. True, some use these animals just because they want their cows in calf and have no intention of rearing the calves, but, on the other hand, it is a fact they frequently change their mind as to the selling of some of the cows or the rearing of a few calves for sale; or, seeing a good-looking heifer calf, they may decide to keep her. This is probably a small but it is a contributing factor in the production of unprofitable cows, and I have known instances where such a bull did not confine his activities to his own herd, but devoted a considerable amount of attention to adjoining herds.

Would it not therefore be advisable that some action be taken in the direction of registration of all bulls other than purebred? This would allow owners who desire to keep what they consider a good grade bull to do so; but if upon inspection by competent officers it is decided that any bull other than pedigreed stock is unfit for registration such decision should be followed by compulsory castration or slaughter. This, in my opinion, would be only a reasonable precaution to protect owners who are doing their best to build up a good herd, and would relieve the dread of many stockmen of the scrub bull upsetting their calculations and thereby causing serious delay to the object they have in view.

Rearing of Calves.

The calf should be kept going from the very start. It should always be kept in mind that with every setback a youngster gets its general development is for the time being retarded, and concurrently with this the proper development of the udder in the female is also affected. Even where the animal is being well cared for, special attention should be given to the immature udder. If found not to to be developing as well as desired, hand massage will be found very beneficial in attracting a fuller supply of blood to that organ and extending and enlarging the cellular tissue. Dogging and chasing of calves should be avoided, strict hygienic conditions should be observed in shelter-sheds, and plenty of shelter should be available at all times. The young animal should have clean grass-runs and attention as to body-lice. When there is evidence of coming horns, the "button" should be removed by knife or caustic.

When one remembers the number of times he has observed calves tied up to a log or stake, standing in a filthy puddle and exposed to all conditions of weather, the wonder is that the number of unprofitable cows is not greater. On the other hand, calves are often well done by until weaned, and then as often as not turned out on most unsuitable pasture (often mostly scrub and fern), and there left to fend for themselves until they are required for the second stage of their existence. By this time all the calf-flesh has disappeared, and hard, dry-coated, pot-bellied, emaciated, expressionless youngsters are

put to the bull with never a chance of doing justice to themselves or their fœtal calf. Here is the double chance of first the mother being made an unprofitable cow, and then of her calf being bred to be one.

Attention at Calving-time.

At this period many a promising cow is ruined for life for want of proper attention. Sanitary conditions are not observed, neither is any examination made to see whether or not any internal injury has been received. Where treatment is required and is neglected the milk-yield is at once affected, and such neglect may lead to the animal becoming permanently sterile, as there is a close sympathetic relationship between the womb and the mammary glands. Sufficient attention is not given to nursing the cow over this critical period, and she becomes to all intents and purposes a cull.

In this connection it may be here represented that the time has arrived (if it is not long overdue) when all unqualified men practising as so-called veterinary surgeons should be registered by the Department of Agriculture, if upon examination they are found to possess sufficient knowledge to be able to efficiently assist stockowners. At present it is no uncommon occurrence to find that more harm than good has resulted from their being called in. Some protection to the stockowner is required in this direction, as far too many men are calling themselves veterinary surgeons without having any qualifications whatever, and misleading the farmer into consulting them.

Purchase of Cows.

Everybody pretends to know about horses, and, before purchasing, makes a good examination as to the animal's suitability for the purpose for which it is required, even although the price asked is a small one. With the cow, however, it is different; in many cases not only "new chums" but older hands do not exercise the care in selection necessary to guard against purchase of defective animals. In this they are not wholly to blame, as at many saleyards no facilities exist for examination to be made. Why farmers as a body do not demand some reform in this respect it is difficult to understand. If cows were penned up singly, then practical men at least would have a better opportunity of examining as to defects, especially those pertaining to the udder. The question of a written guarantee should also be considered, embracing freedom from all defects likely to influence the milk-yield—that is, defects known to the seller or which by reasonable care could have been known to him. This would include abortion, vaginal catarrh, and defects of the udder, whether caused by disease or injury. All these have at one time or another been the subject of articles in the *Journal*, and need not be gone into now, but it may be interesting to state that not half of the cases of mammitis (mastitis) reported are of contagious origin. The majority are therefore preventable more easily than is the contagious form. Unsuitable feeding is a frequent cause of mammitis, as also are chills, which could be prevented, or at least not neglected, in the early stages. The milking-machine, although a great blessing generally, has its drawbacks in that it is a powerful agent in the spreading of udder-diseases and a fruitful cause of injury to the udder.

It is needless to point out that all the above-mentioned conditions contribute largely to the number of unprofitable cows. They by no means exhaust the list, but may be sufficient to demonstrate how complex the subject really is, and how difficult it would be to introduce legislation at the present time which would not leave many loopholes available for dishonesty, thereby giving only a false sense of security and tending to make purchasers even more careless in selection than they are now.

It has often been said that something should be done to protect returned-soldier settlers and other inexperienced persons against the purchase of cull cows, and it seems to be the general opinion that lack of experience alone accounts for their purchasing such animals. This is not always the case. My experience of returned soldiers and observations of their qualifications to make good farmers is not that they do not possess the average knowledge essential to success, but rather that they are handicapped for want of sufficient capital with which to buy good cows. Under present circumstances they buy cheap cows, trusting to their luck in that a discarded animal may do much better in a new home or do better this season than last. In this they are sometimes not disappointed, but the risk is decidedly against them. Are we not, therefore, attaching too much importance to the cull cow's disposal, to the neglect of more pressing reforms?

Milk-testing.

Needless to say, milk-testing is the primary step in the eradication of the unprofitable cow. If its economic value is to be judged by the progress made by testing associations and individual owners since its inception in this country, then here is a reform which should be heartily supported by every one interested in the dairy industry. Finding out the unprofitable cow is of more importance than her disposal, because even if she is disposed of to the butcher at a present loss this would be more than compensated by the ultimate gain. But even here sound judgment as to stock-management is required in conjunction with the milk-testing, as every experienced farmer knows that the milk test, both as regards quantity and quality, depends largely upon general conditions. As a cow to do her best must be under the most favourable conditions for doing so, her general health must be good; any neglect in proper feeding is fatal to success. Congenial surroundings are necessary, and the human touch is indispensable. She must be treated as a chum and a profitable partner in the concern, and not just a part of a milking-machine. Good sanitation must be always observed; her disposition, likes, and dislikes must be studied; and, above all, regularity in attendance should never be overlooked.

Calf Clubs.

Another good move is the formation of calf-rearing clubs, which should be encouraged throughout the Dominion in every possible way, even by those interested only in the prevention of cruelty to animals, because here the coming farmer is educated to take a pride in the health, well-being, and comfort of the animal under his or her charge, thus developing a love for animals worthy of all support. If club

committees will guard against any competitor taking an advantage over the others by giving his calf " tit-bits " not mentioned on the feeding-sheet, there is great promise for such clubs being of immense value, but nothing discourages children more quickly than to have reason to believe that they are not having a fair deal.

DISPOSAL OF THE CULL COW.

Although several suggestions have been made as to the best method of disposal, including branding or spaying, none seems to meet with general approval, because the honest farmer who wishes to dispose of an unprofitable animal can readily dispose of her to the butcher, and will do so without any coercion. The action of many others would be doubtful; in fact, they would neither brand nor spay without compulsion. The spaying of cows has a few advocates, but this practice is not likely to come into general favour, and, indeed, has been already discarded by many who have tried it. The operation should never be performed unless the animal is under the influence of an anæsthetic, otherwise it is a cruel operation, and at best it requires skilful manipulation.

Following upon the lines already taken in suggesting a better system of management, I believe that the solution of the cull-cow problem is in the hands of the stock auctioneers. The time is opportune for auctioneers to come to the assistance of their best clients, the stockowners, by throwing their weight into this question and establishing a special line of their business under the management of capable men dealing solely with dairy cattle. These men could make it their business to find out all about the animals and their records. They could then be classed as specially good milkers, good milkers, or culls. If the latter, it would be arranged that the animals be all penned separately from the others so that no mistake could be made. I have no hesitation in saying that such action on the part of auctioneers would be of the greatest assistance to the dairy industry, besides reflecting to their own credit and profit. If we could only secure the co-operation of salesmen, confidence would be placed in them, a great relief to the inexperienced buyer would result, and the cull-cow question would be settled in the most satisfactory manner it is ever likely to be.

Seed-samples for Analysis.—Samples sent to the Department's seed-station for analysis should be of at least 1 oz. of the smaller and 2 oz. of the larger seeds. It is particularly important that the sample should be representative of the line from which it is taken—that is, that the line should be sampled with extreme care. This is a matter requiring special attention, as many, if not all, of the discrepancies arising in the germination of such seeds as Chewings fescue and cocksfoot are due to the sending-in of samples not carefully made. Seed should be taken from the top, bottom, and middle of a sack, and from every sack in the line, then well mixed and the sample put up.

Limewash for Cow-byres.—Mr. A. T. P. Hubbard, Inspector of Stock at Masterton, states that he has found the following very effectual as a limewash for cow-byres: Quicklime, 1 sack; fat, 25 lb.; treacle, 5 lb.; salt, 5 lb. The method of preparation is to slightly wet the lime and add the other materials while it is hot, then thoroughly mix with more water to right consistency. Being weatherproof, the wash is also suitable for painting the exterior of buildings, &c.

THE GRASSLANDS OF NEW ZEALAND.

PRINCIPLES OF PASTURE-ESTABLISHMENT.

(Continued.)

E. BRUCE LEVY, Biological Laboratory, Wellington.

SEASONS FOR ESTABLISHMENT OF PASTURES.

In farm practice there are three more or less distinct periods or seasons of the year when an attempt is made to establish pasture-plants: (1) With or without a cereal, in the early spring, or in a spring cultivation of winter-sown cereals; (2) together with rape, in November; and (3) with or without a winter cereal, in the autumn. The natural seeding-time is in the autumn—nature herself sowing then. The seeds of those plants which are tender lie dormant until the warmer weather of spring; the more hardy ones germinate and establish in the autumn, but for the most part do not make much growth until the succeeding spring. Man has worked on the plasticity of nature, and from wild stock has produced high-yielding but, in general, tender plants. These must be sown at the most opportune moment on a specially prepared seed-bed.

DETERMINING FACTORS.

The factors that determine at which period or season of the year the pasture will be sown are primarily (1) climate and location; (2) nature of soil, and its condition with regard to drainage or to its weed-seed content; (3) previous crop or rotational system practised; (4) purpose for which the pasture feed is required; (5) species that comprise the mixture sown. A short consideration of each of these points will serve to show somewhat how each of these factors helps to decide the period when the pasture will be sown.

Climate and Location.

Climate and location to a large extent determine spring or autumn sowings for our pastures. Where early winter frosts are severe spring sowings are general. This is due largely to two factors: (1) In a district where the winter is severe a good deal of supplementary winter forage is necessarily grown in order to tide over the long period of little pasture-growth, and the land on which these forages are grown is ready for sowing down again in the spring; (2) the action of frost on newly-laid-down pasture is often very harmful, not so much from the actual frosting of the young grass, but in an actual lifting of the young plants right out of the ground (Fig. 100). Hence, unless pasture-plants are well established before severe frosts arrive the damage by frost-lifting is often very considerable, and so, in order that establishment may be well effected by winter-time, spring sowings are preferable to autumn ones (Fig. 101). The lifting effect of frost is dependent to some extent on the nature of the soil, loose friable soil lifting much more readily than the firmer and more coarsely textured ones. The actual lifting is due to the expansion of the soil-water when this water

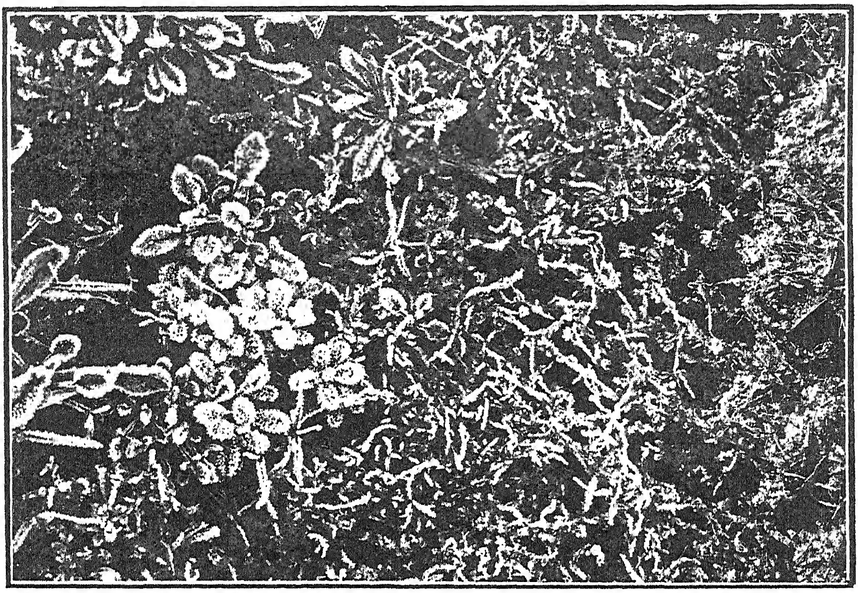


FIG. 100. SHOWING FROST-LIFTED SURFACE IN AN AUTUMN WORKING OF THE LAND IN SOUTHLAND.

Note the honeycombed appearance indicative of frost-lift.

FIG. 101. SPRING-SOWN PASTURE IN SOUTHLAND, WELL ESTABLISHED BEFORE THE WINTER CAME ON.

There is no indication of frost-lift in this sowing.

 [*Photos by E. Bruce Levy.*

is frozen into ice, and it is only when the temperature falls low enough to freeze the soil-water that lifting can take place. The season experienced in any one year may modify the general practice of spring sowing in a cold climate. If good summer rains have fallen it is often possible to get in very early autumn sowings, and these may become sufficiently well established to resist the frost-lift. A dry summer, on the other hand, means a late start in the autumn for the pasture, and then it certainly is risky to autumn-sow.

In the South Island spring sowing is general, and for a great part consists in sowing along with a cereal in the early spring or together with rape in November. In these sowings it is obvious that the time of sowing of the pasture is determined very largely by the needs of the temporary cover-crop, the pasture itself being secondary in consideration as far as the establishment of the crop as a whole is concerned. In Southland the oat crop must be in fairly early, else the harvesting is thrown too late in the autumn. Hence also we find that, irrespective of whether early spring sowing for grass is good or bad, the grass is sown at this time. In Canterbury rape is required for summer feed, and for this purpose it is best sown in November. Incidentally the grass gets sown also along with this crop in November. In Canterbury and north Otago also the autumn-sown cereals need cultivating in the early spring, and, again, at this time the grass goes in. In other words, in all these cases the pasture-sowings are made to fit in with the demands of the annual cover, cash, or feeding-off crop. The writer sees no great objection to this where short-rotational-farming practice is in vogue, but just wishes to make the point clear that if the main objective is grassland, then the consideration given to grass-establishment should be primary, and not secondary, as is the case where the cereal for chaff or for grain or some other cover-crop is included.

Particularly does permanent pasture claim every facility and every advantage in establishment that the farmer can give. Here grass-establishment should be the primary consideration, and any additional crop that may be grown along with it should receive secondary consideration only. In Southland and elsewhere there is often a great struggle against spurrey or yarr (Fig. 102), and certainly in these cases it is a great advantage to have the cereal included, owing to its being able to get ahead of that weed; and if the cereal were fed off in the green stage the pasture would be benefited by the reduced content of spurrey. Undoubtedly rape functions well as a cover-crop, being superior to oats for chaff or grain, and this is due almost entirely to the fact that rape is a fed-off crop. The practice of according the pasture-sowing with a temporary annual cover-crop reaches the zenith of indiscriminate application in certain bush-burn country where the felling is fired in summer—January or even December—in order that the turnips sown along with the grass may be assured of success. Here, on land that can practically never be renewed by the plough, the practice of considering the establishment of a purely temporary element like turnips before that of the grass must be absolutely condemned. The primary objective undoubtedly should be grass, and to prejudice the grass "take" in order that the turnips may be a success is almost criminal in an agricultural sense.

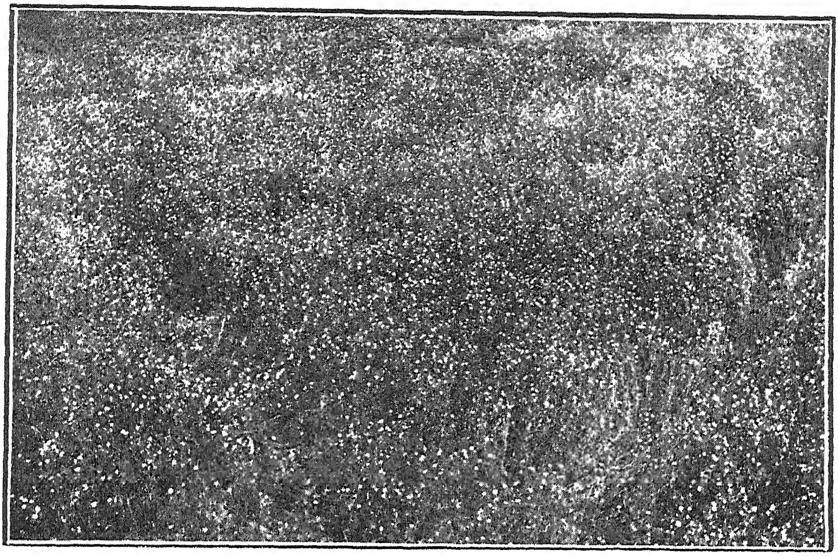


FIG. 102. SPURREY OR YARR IN SPRING-SOWN CROPS.

Rapidly establishing and quick-growing plants must be included in the sowing to compete with this weed-growth.

FIG. 103. A WINTER ANNUAL, TOAD-RUSH, IN AN AUTUMN-SOWN WHEAT CROP ON LAND THAT BECOMES WATERLOGGED IN THE WINTER.

On such land spring sowing should be carried out.

[*Photos by E. Bruce Levy.*

Nature of the Soil ; Drainage and Weed-seed Content.

On good first-class land there is little to pick and choose between autumn and spring sowings as far as the ability to establish is concerned. This presupposes no early winter frosts, and that the weed-seed content of the soil is not unduly high. On light soils that do not retain moisture well either very early spring sowings or else autumn sowings are necessary. Generally speaking, under such conditions autumn sowings are much to be preferred, and the general principles outlined in dealing with sand-country (see *Journal* for November last, pp. 258–261) apply. Many low-lying and poorly drained soils are often too wet for satisfactorily working to lay down the pasture in the spring, and on these soils autumn sowings are usual. Late spring sowings, however, may be done here, as there is less likelihood of drying-out in the summer than on more elevated situations; and, again, if spring-sown, the pasture will be better able to withstand the renewed wet condition of winter if well established before winter comes on. Further, in these low-lying situations winter annual weeds, such as toad-rush (Fig. 103), are often extremely bad in autumn-sown crops.

On the steep bush-burn country the farmer has no alternative, and he has to sow in the autumn. The general practice is to burn in February or even earlier, and to sow the seed in the ashes of the burn even while these are yet warm Whether or not early autumn burning is imperative in the conversion of forest land to grass the writer at present is not in a position to say. It remains a fact, however, that the succeeding dry months of autumn are extremely difficult ones for the newly sown grass. Fig. 47 of this series in the *Journal* for March last (p. 157) depicts this point fairly well, and there is no doubt that very frequently much of the failure to secure a good sole of grass on bush-burn is due to the fact that often too long a dry spell intervenes between the time of sowing and the rains of autumn. Generally speaking, on a bush-burn moisture is drawn from below to the surface through the heat of the fire, and this moisture is usually sufficient to start germination of the seeds, but the scorching sun soon dries out the surface, leaving the young seedlings to wilt and die.

The weed-seed content of the soil upon which pastures are being laid down is often an important consideration. From estimates made by the writer, by actual counting of all plants that established on small areas in the early stages of the development of pastures, it has been found that good first-class arable lands may contain viable weed-seeds (which actually establish in a sowing) to the enormous number of fifteen million plants per acre, representing a sowing of about 100 lb. of weed-seed per acre. Moreover, such weeds that germinate occur in the first ½ in. or so of soil only, whereas these soils actually contain weed-seeds to a depth of 6 in. or 8 in.—possibly more where the working has been deep. When the weed-seed content is as high as this it becomes a very potent factor in determining whether the sowing shall be in the autumn or in the spring. Most of our weeds of arable land are annuals which establish in the early warm weather of spring. Many such annuals—namely, summer annuals (Fig. 104)—establish only in the spring, and among the more common ones may be mentioned fat-hen, smartweed or red-shank, wireweed, black nightshade, purslane, bindweed, &c. If the pasture mixture be spring-sown

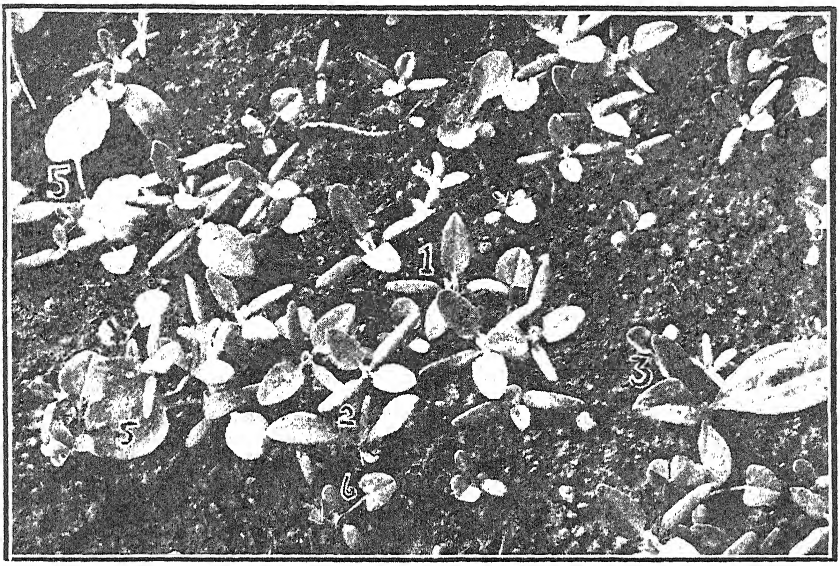


FIG. 104. SUMMER ANNUAL WEEDS (MAINLY FAT-HEN) APPEARING IN A SPRING SOWING OF WHITE CLOVER.

(1) Fat-hen, (2) wireweed, (3) smartweed, (4) sow-thistle, (5) broad-leaved dock, (6) white clover. Where summer annuals are as bad as this in a soil the pasture should be autumn-sown wherever possible.

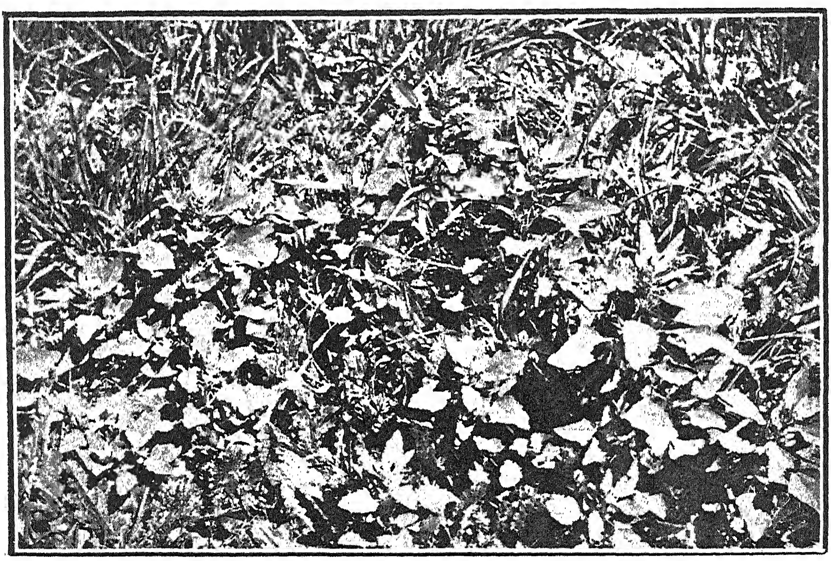


FIG. 105. FAT-HEN IN A SPRING-SOWN PASTURE BECOMING A STRONG COMPETITOR IN THE PASTURE ASSOCIATION.

If this pasture had been autumn-sown scarcely a fat-hen seed would have germinated.

[*Photos by E. Bruce Levy.*

on land infested with seed of these weeds they become powerful competitors (Fig. 105), whereas if the pasture is autumn-sown there is no danger from them whatever. If these weeds germinate at all in the autumn they never become well-established, vigorous plants.

Fig. 106 is very instructive, and indicates very well how spring or autumn cultivation of certain lands influences the class of growth that may follow. The plot shown was dug over in the autumn, and left so that it might be seen what weeds would occupy the ground. The annual meadow-grass (*Poa annua*) constitutes the main mass of growth, but associated with it are the following weeds: Cut-leaved cranesbill, shepherd's purse, buttercup, and hogscress. This portion of the plot is shown to the left of photo. In the following spring this

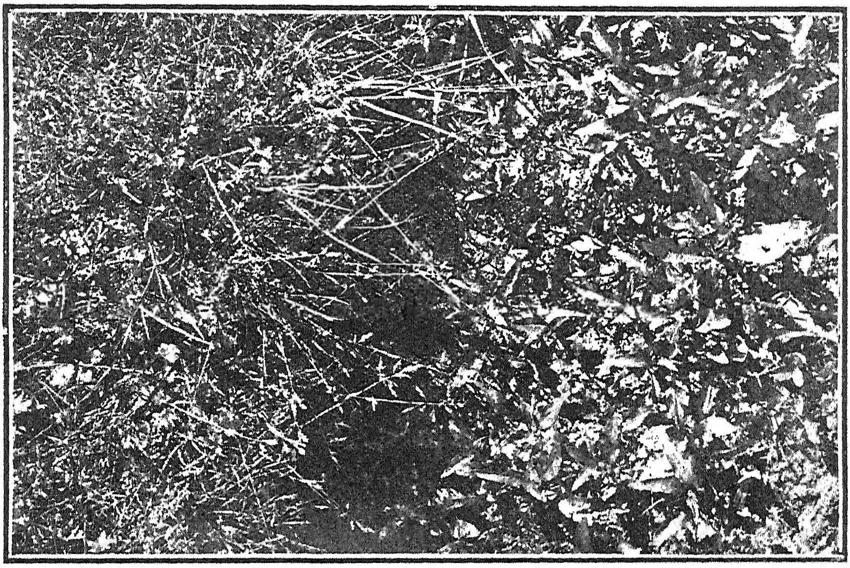


FIG. 106. SHOWING A MARKEDLY DIFFERENT VOLUNTEER GROWTH ON THE SAME SOIL, BUT WHERE CULTIVATION HAS BEEN CARRIED OUT AT DIFFERENT SEASONS OF THE YEAR.

Autumn working on the left and spring working on the right of photo.

[*Photo by E. Bruce Levy.*

plot was in part again dug over, and left to see what natural spring growth would take place. The growth that followed on the newly dug portion was one mass of the summer annual, smartweed. This is shown to the right of the photo. Some Poa annua also established, but this had little chance against the more vigorous weed. From the fact that Poa annua could establish so well in the autumn one may infer that an autumn sowing of grass on this land would have a much better chance to establish successfully than if sown in the spring when the weed competition is so great. Most perennial weeds, such as sorrel, dock, ox-eye daisy, creeping buttercup, field-daisy, &c., germinate readily in the spring, and while they may not become so immediately aggressive as fat-hen, smartweed, &c., yet they are usually able to

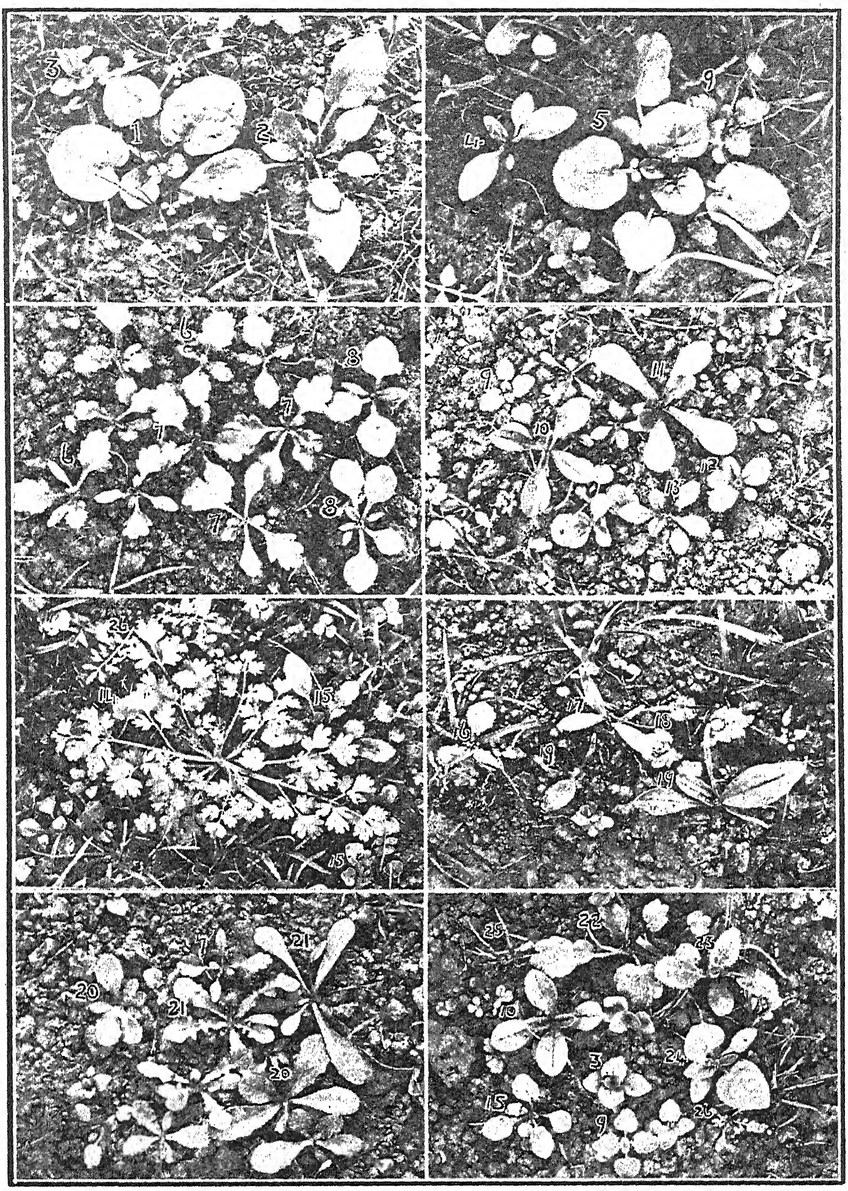


FIG. 107. SHOWING THE CLASS OF WEEDS THAT ESTABLISH AS WELL IN THE AUTUMN AS IN THE SPRING.

(1) Broad-leaved dock, (2) curled-leaved dock, (3) scarlet pimpernel, (4) greater plantain, (5) American cress, (6) groundsel, (7) ox-eye daisy, (8) sorrel, (9) speedwell, (10) mouse-eared chickweed, (11) catchfly, (12) forget-me-not, (13) slender mouse-eared chickweed, (14) fumitory (bad in spring-sown crops), (15) shepherd's purse, (16) sow-thistle, (17) wireweed (usually only in spring), (18) small-flowered buttercup, (19) rib-grass, (20) catsear, (21) dandelion, (22) hairy buttercup, (23) Scotch thistle (more common in spring), (24) black nightshade (most common in spring), (25) annual meadow-grass, (26) hogscress.

[*Photo by E. Bruce Levy.*

persist in a permanent-pasture sowing and to make themselves felt later in the history of the pasture. Perennial weeds such as those mentioned, however, establish well also in the autumn (Fig. 107). This is true also of another set of annual weeds to which belong spurrey, shepherd's purse, fumitory, small-flowered buttercup, American cress, annual meadow-grass, hair-grass, &c. Despite the fact that certain annual and perennial weeds do establish in the autumn, undoubtedly spring is the appointed time for the germination and rapid establishment of most weeds, and particularly annuals.

The next fact to bear in mind in regard to these weeds is that they will not establish in the spring following on an autumn sowing. Once a sward of grass or other cover is effected during that period over which

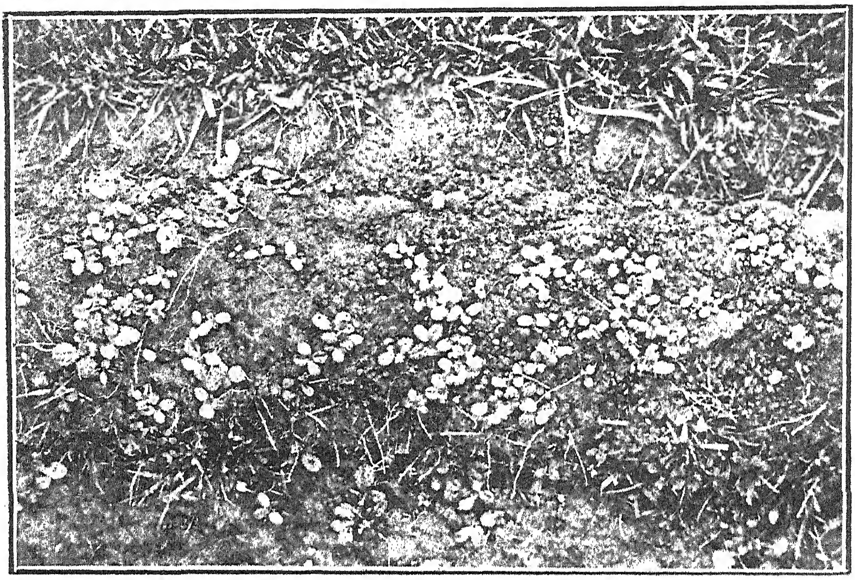


FIG. 108. SHOWING SCOTCH THISTLE ESTABLISHING ON AN UPTURNED FURROW, THE SEED HAVING LAIN DORMANT IN THE GROUND FOR OVER TEN YEARS.

[*Photo by E. Bruce Levy.*

the annual weeds are dormant there is no likelihood of annual-weed establishment later on, provided the turf of grasses and clovers is maintained. It is really an interesting fact how many seeds seem to have a sort of intuitive power in this respect: they germinate only when establishment is possible, and unless they "feel" the conditions are right for establishment they lie dormant perhaps even for upwards of twenty or more years. Fig. 108 illustrates this point very well. The photo shows an upturned furrow which was run across a permanent pasture during the early spring. The pasture had been down for at least ten years, and there was no sign of Scotch thistle on the area itself. Within a few weeks of the furrow being turned Scotch thistle germinated along that upturned furrow, forming a definite line of

thistle across the paddock. Over one hundred thistle-seeds germinated and established per linear foot of furrow. Many farmers will have met with much the same thing in paddocks that have been heavily stocked during the winter. The turf becomes broken, and light and air—two necessary stimulants to germination—are admitted to the dormant thistle-seeds, which respond by germinating in the spring, and the opened turf cut up by the heavy winter grazing allows establishment of the thistle to take place.

The vegetation to which the ground sown is likely to revert also influences to some extent the question of the season when sowing should take place. It may be set down as a general principle in the control of most perennial weeds, fern, blackberry, &c., that there should be a sufficiency of feed to maintain a heavy stocking at that period of the year when the weed is most vulnerable. In the case of the fern, for instance, this is so when it is just at the curl stage; and in the blackberry when the young tender shoots appear through the ground. Fern-fronds and young fresh blackberry growth appear in the early spring — in October mainly — whereas spring sowings, particularly of permanent pastures, are not rapid enough to produce feed to allow of their being stocked in October, and hence autumn sowings are very much more to be desired. Another advantage of autumn sowings is that most perennial weeds are more or less dormant during the late autumn and winter months, so that the young grass has then no aggressive rival to hinder its establishment. Against autumn sowings on weedy land, however, must be set the fact that competition between the pasture-plants sown and the weeds that come up in the "take" is not nearly so keen as when the sowing is made in the spring, and consequently more weeds (those that are slower) may establish in autumn-sown fields. Thus weeds like ox-eye daisy, field-daisy, hogs-cress, dock, &c., are fairly slow to establish from seed, and these may be readily smothered out in spring-sown pastures, but they are given a better chance to establish in autumn sowings. It will thus be seen that the nature of the weeds whose seeds lie dormant in the soil influences to some extent the time of sowing. Where summer annuals are bad, undoubtedly the sowing, where possible, should be in the autumn.

Previous Crop or Rotational System practised.

Generally speaking, throughout New Zealand there is a demand for supplementary forages, and this is particularly true of the dairy farm, especially in the South Island. These forage crops are usually grown on old pasture lands, and are usually followed after one or two seasons by pasture. The land on which the crops have been grown is available for sowing in the spring, and the usual procedure is to spring-sow pastures on the land occupied by the winter supplementary crop. Hence it follows that the greater the necessity of growing winter supplementary forages in any one district the more regular will be the practice of spring sowing of pastures. This is true virtually of all those districts where really only one crop a year can be grown. In the North Island very frequently two crops can be grown quite well in the one year, and when this is the case it is usual to so work the rotation that the crop preceding the pasture-sowing is off the ground in time to allow of autumn sowing of pastures. Rape, soft turnips, green maize, and special hay crops like oats and

tares for dairy-cow feeding may be cited as such crops. The more general procedure in rotational farming, however, is to study not so much the season most fitted for establishing the pasture, but that season which fits in best with the rotation practised. Here, again, grassland-establishment is relegated to secondary consideration, and it often happens that the previous crop may either be late in maturing or else its utilization is delayed, so that the grass-sowing is hurried in without that essential preparation of the land that is so important to success. In a district where the pasture occupies the land for a considerable portion of the rotation the crops that precede its establishment should be so regulated that while they occupy the land they should be in a sense preparing it for the grassland again. Just how this should be done in the various districts throughout New Zealand is beyond the scope of this article, but the principle involved is one that is well worth considering.

Purpose for which the Pasture-feed is required.

Great as is the value of special supplementary crops, such as roots and green fodders, there is no doubt that much use can be made of the pasture to act as a special winter- and summer-feed producer, and to effect this it is obviously necessary to sow at different periods of the year. In the main the temporary pasture or the short-rotation pasture are the only suitable ones to provide supplementary feed. Good summer feed may be produced by spring sowing of pastures in which perennial and Italian rye-grass are the main species used. This is recognized by many farmers, and the November sowing in combination with rape is primarily a sowing to tide over the summer period. Good winter feed may be produced by autumn sowing of much the same type of pastures, and if a cereal be added to the rye-grass mixture very early winter feed can be produced. The advisability of sowing for such a purpose only quickly establishing grasses like the rye-grasses has been sufficiently stressed earlier in this series (see *Journal* for last May, p. 268, and August, pp. 67–68). A truly permanent pasture should on no account be sown to act as supplementary feed; it should be laid down only in that season and under the best possible conditions for the successful establishment of all its constituents.

Species that comprise the Mixture sown.

Rye-grass may be sown at any season of the year with prospects of success. Even when sown under very dry conditions germination takes place and the plants become established, although the growth will be small until rains fall. With other grasses, however, this is not the case. Cocksfoot, crested dogstail, the Poas, meadow-foxtail, &c., will not germinate under such dry conditions as does rye-grass. In other words, their adaptability of range of conditions is not nearly so wide as in the case of rye-grass. Late autumn sowings of rye-grass are often very successful, but failure after failure of cocksfoot to establish has been recorded owing to too late a sowing in the autumn. Again, late spring sowings of cocksfoot are rarely successful. It must be firmly borne in mind that certain grasses are infinitely slower to establish than others, and whereas a quick-establishing grass like

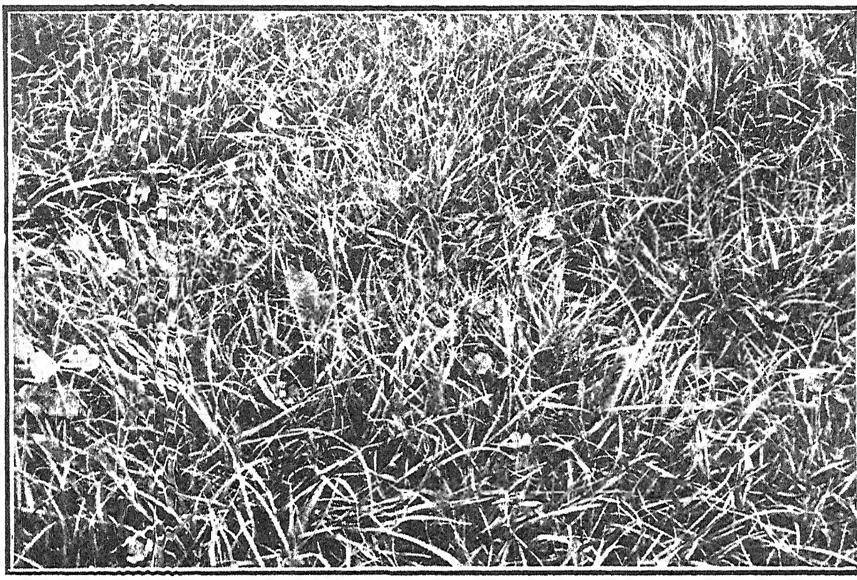


FIG. 109. SPRING-SOWN PERENNIAL RYE-GRASS "TAKE," SHOWING HOW RYE-GRASS IS CAPABLE OF SUPPRESSING ALMOST ALL WEED-GROWTH THAT MAY GERMINATE IN SUCH A SOWING.

All weeds except an odd dock or so were smothered out.

FIG. 110. SPRING-SOWN COCKSFOOT ON THE SAME SOIL AND UNDER EXACTLY THE SAME CONDITIONS AS THOSE OF FIG. 109.

Note the more open association and the weeds fumitory, fat-hen, curled dock, chickweed, and black nightshade, all well established. Docks were particularly numerous in the "bottom" of the sward.

[*Photos by E. Bruce Levy.*

rye-grass can establish while the conditions may be fairly good, bad conditions may come on before this corresponding stage in the case of the slower-establishing ones is reached. Under the very best conditions for germination rye-grass will germinate and will appear above ground in four days, while cocksfoot and crested dogstail need fully ten days; the Poas need ten to fifteen days, and even as much as twenty-four days before all the seeds sown have even germinated. Clearly, then, under rather adverse conditions rye-grass has the much better chance of establishment, and this has been demonstrated over and over again in pasture-sowings. Thus we may find that of a mixture sown only rye-grass will have established, and this grass, even though it may make little growth until rains fall, is in a position immediately to spring ahead as soon as good growing-conditions return. The permanent species will thus be still further handicapped in their efforts to establish owing to the cover of the rye-grass growth.

Further, as far as weed-seed content of the soil is concerned, little consideration need be given when rye-grass is the main species of the mixture, for this plant by its great vigour and capacity to smother can outdo most annual or biennial weeds that may establish along with it. Figs. 109 and 110 show this point fairly clearly. Both are pure sowings made in the spring. The great increase in the amount of weeds established along with the cocksfoot as compared with that in the rye-grass is very noticeable. The plots are adjoining, and these photographs were taken 3 ft. one from the other.

The choosing of that season best fitted for establishment is really of great importance, for even rye-grass if it gets a check in its early development never assumes the same vigour as does a plant which develops straight away without any check. This is perhaps a reason why a great many farmers prefer spring sowing to autumn sowing. There is no doubt that plants germinating and establishing in the early spring do better than those which germinate in the autumn, and which, after just getting established, are checked by the winter conditions. The rapidity with which certain light soils dry out in the early summer, however, precludes the possibility of good spring establishment of slowly germinating species, whereas the autumn, with its less vigorous competition and usually longer period for establishment, is in general the most suitable for permanent-pasture establishment on these soils. Where there is a long spring and the ground remains moist for a longer period, and where summer annual weeds are not over-plentiful, spring sowings are usually more successful than autumn ones. The question, however, is a big one, with so many influencing factors that no hard-and-fast rule may be laid down.

(To be continued.)

Importation of Plants, &c., from New Zealand into Australia.—Advice was received last month from the Government of the Commonwealth of Australia that owing to the existence of pear-blight or fireblight (*Bacillus amylovorus*) in New Zealand the importation into Australia from the Dominion of all plants and parts of plants (including fruit) is prohibited; provided that agricultural seeds, grass-seeds, vegetable-seeds, flower-seeds, and the seeds of pine-trees and of ornamental shrubs or trees may be imported, subject to the exception of the seeds of any plant of the family Rosaceæ and the seeds of any fruit-tree.

WINTER FEEDING OF DAIRY COWS.

TRIAL WITH SILAGE, ETC., IN SOUTHLAND.

R. B. TENNENT, N.D.D., Instructor in Agriculture, Dunedin.

DURING the months of June and July last a preliminary feeding-trial was conducted at Gore, with a view to obtaining some indication as to the milk-producing value of oat and pea silage when fed to dairy cows, in contrast to the usual Southland winter ration of turnips and straw. The trial was designed to afford an indication of the results which might reasonably be expected from feeding oat and pea silage, and was only intended to act as a guide for future experimental work of a similar nature. It was not intended at first that the results of this test should be published, on account of the facts that complete supervision of the herd was impossible, that no control group of cows was recorded, and that many other important details which should have been rigorously adhered to in a test of this nature had, through force of circumstances, to be neglected. The results, however, despite the admittedly imperfect manner in which they were obtained, are so striking that it is deemed advisable to publish them so that when further trials are conducted comparison with the results already ascertained will be afforded.

For the purpose of the trial Mr. T. Pryde, a dairy-farmer at Gore, kindly placed his herd at the disposal of the Department, and from this herd were selected ten cows which had calved some time prior to the test. These cows were housed in the byre overnight and during inclement weather, so that an excellent opportunity was given to feed the animals with weighed amounts of food. Those selected were a mixed lot of grade cows, giving on an average 17 lb. of milk daily. As practically no grass was available at this particular time of the year the amount of food from this source was so negligible that no account is here taken of it.

PLAN OF THE EXPERIMENT.

As already indicated, the experiment was intended to show to what extent oat and pea silage could replace turnips and straw, and accordingly weighings were made of the amount of turnips and straw consumed daily by the average cow. From this it was ascertained that a cow consumed daily 131 lb. of turnips and 13 lb. of straw. As the trial progressed, the results obtained necessitated a modification of the original plan of feeding, with the result that on completion of the trial five separate rations had been fed to the cows. Each ration was fed for a period of approximately nine days, and the results obtained from the different rations were contrasted and afforded some useful information.

As presenting the relative value of each ration the following tabulation, showing the total amount of dry matter, digestible proteins, and carbohydrates and fat, will be of interest. It will be

observed that particulars as to the deficiency or excess of each of these substances are stated. To obtain these each ration was contrasted with the Wolff-Lehmann standard, which shows the average dairy cow yielding 22 lb. of milk daily to require each day 29 lb. of dry matter, 2·5 lb. of protein, and 14·10 lb. of carbohydrates and fat.

Rations fed during the Trial.

Ration fed.	Dry Matter.	Digestible Protein.	Digestible Carbohydrates and Fat.
First Period (13th to 21st June).			
	lb.	lb.	lb.
131 lb. turnips	12·87	1·17	8·58
13 lb. oaten straw ..	11·80	0·14	4·54
Total	24·67	1·31	13·12
Deficit ..	4·33	1·19	0·98
Second Period (22nd to 30th June).			
50 lb. silage	15·60	1·20	7·65
13 lb. oat straw ..	11·80	0·14	4·54
Total	27·40	1·34	12·19
Deficit ..	1·60	1·16	1·91
Third Period (1st to 9th July).			
13 lb. oat straw ..	11·80	0·14	4·54
50 lb. silage	15·60	1·20	7·65
20 lb. turnips	1·98	0·18	1·32
Total	29·38	1·52	13·51
Deficit ..	0·38*	0·98	0·59
Fourth Period (10th to 19th July).			
131 lb. turnips	12·87	1·17	8·58
6 lb. lucerne hay ..	5·19	1·04	1·82
6 lb. red-clover hay ..	5·08	0·42	2·51
Total	23·14	2·63	12·91
Deficit ..	5·86	0·13*	1·19
Fifth Period (20th to 29th July).			
40 lb. silage	12·48	0·96	6·12
60 lb. turnips	5·94	0·54	3·96
6 lb. lucerne hay ..	5·19	1·04	1·82
6 lb. clover hay ..	5·08	0·42	2·51
Total	28·69	2·96	14·41
Deficit ..	0·31	0·46*	0·31*

* Excess.

From this summary it will be observed that in the case of most of the rations there is a decided deficiency in digestible protein, carbohydrates, and dry matter, which could easily have been corrected by the addition of some concentrate. As the average farmer in Southland does not yet fully appreciate the use of concentrates it was decided not to use any during the trial. Comparing the turnip and straw ration of the first period with the silage and straw ration of the second period, it will be observed that both are quite comparable, having for all practical purposes equivalent weights of dry matter and digestible compounds.

The silage used throughout the trial was made at the Gore Experimental Area from a crop chiefly composed of Webb's oats and Grey Partridge peas. This silage was readily eaten by stock, and was of excellent quality. The following is the result of an analysis made of it: Moisture, 68·8 per cent.; ash, 2·1 per cent.; fibre, 10·4 per cent.; ether extract, 1 per cent.; albumenoids, 2·4 per cent.; carbohydrates, 15·3 per cent.

RESULTS.

A few remarks as to the progress of the experiment will prove of interest, and serve to indicate to what extent the various rations affected the animals.

First period: The ration of turnips and straw used during this period was really a continuance of the ration which the cows had been receiving for the two months prior to the test, and consequently no difficulty of feeding was experienced. The turnips were fed whole, and the straw was not chaffed. Practically no wastage occurred.

Second period: The main object throughout this period was to gradually replace the turnips with silage in such a way that during the last three days of this period the cows would be on a ration of 50 lb. of silage and 11 lb. of oat straw. This was done, but there was such a serious drop in the milk-supply that the trial on silage alone had to be discontinued. A feature to be noted was the fact that where silage was fed the fæces of the cows became dry and hard. This, of course, was to be expected, bearing in mind that the ration was changed from turnips with a high moisture-content to silage with a much lower moisture-content.

Third period: With a view to correcting the dry condition of the fæces 20 lb. of turnips was added to the previous ration, and this rectified matters.

Fourth period: Having noted the results obtained from silage it was decided to eliminate this from the ration, in order to see whether the cows could be brought back to the former production. Turnips, lucerne hay, and red-clover hay were utilized for this purpose, and satisfactory results were obtained.

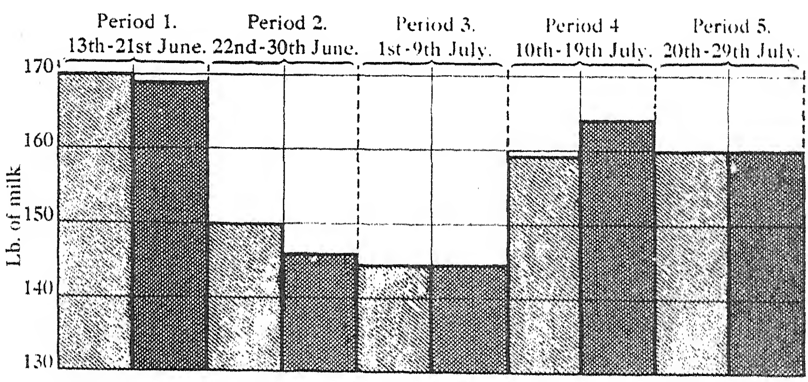
Fifth period: Throughout this period a mixture of turnips, silage, and hay was used, in order to produce a ration which would supply the full amount of necessary digestible compounds. This ration, however, contained an excess of digestible compounds, and a considerable amount was wasted by the animals.

In giving actual figures as to the results of the test it is well to remember that the best indication is obtained from the records of the

last four days in each period, when it might reasonably be expected that the animals had responded to the ration being fed to them. The following table of results, then, gives the total amount of milk produced by the cows during each period, the average daily yield during each period, and the average daily yield during the last four days in each period :—

Period.		Total Yield.	Daily Average Yield.	Average Daily Yield of Last Four Days.
		lb.	lb.	lb.
First (9 days)	..	1,536	170	169
Second ,,	..	1,354	150	146
Third ,,	..	1,309	145	145
Fourth (10 days)	..	1,594	159	164
Fifth ,,	..	1,605	160	160

The figures are diagrammatically expressed in graph 1, which gives a clear indication of the respective yields obtained from each ration. Graph 2 shows the daily yield of the ten cows under test for each of the periods. From this it will be realized how serious was the drop in milk-supply during the second period, when turnips were gradually being replaced by silage, and that the lowest-producing days were from 28th to 30th June, those days on which the cows received a ration of 50 lb. of silage and 11 lb. of oaten straw alone.

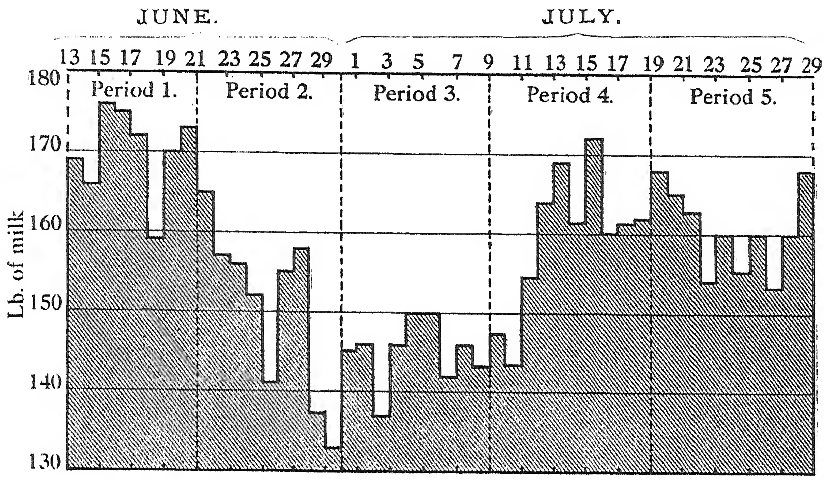


GRAPH 1.

Showing average daily yield of milk (in pounds) from herd for each period, and average for last four days in each period of the feeding-test. Light shading indicates average daily yield for whole period; dark shading shows yield for last four days of period.

That the milk-supply could be kept up to its previous standard was demonstrated by the ration fed during the fourth period, and this ration is a most satisfactory one from a feeding point of view. When contrasting the results obtained from this ration with the orginal ration of turnips and straw, it must be borne in mind that there is a difference of over three weeks in the lactation period.

It is further to be noted that at the commencement of the trial the cows were in a fairly poor condition, and not so well furnished as one could have desired. On conclusion of the test the cows had improved considerably in condition, clearly indicating that quite a percentage of the rations then fed was being utilized for flesh-formation rather than for the production of milk.



GRAPH 2.

Showing daily yield of milk (in pounds) from herd during the different periods of the test.

On the whole, therefore, as a result of this preliminary experiment, oat and pea silage does not compare very favourably with turnips for milk-production. On a comparative basis 2 lb. of turnips are equal to approximately 1 lb. of silage, and on the ground of economy it is dubious if the growing of silage can ever replace the growing of turnips for dairy cows in Southland.

The action of Mr. Pryde in placing his herd at the disposal of the Department for the test is cordially acknowledged, for it is realized that without his assistance and co-operation the results recorded here would not have been possible.

Honey-grading Store, Auckland.—The New Zealand Co-operative Honey-producers' Association's store at Stanley Street, Auckland, has been appointed a grading-store for honey, in place of the New Zealand Express Company's store at Beach Road.

Marlborough Stock-branding Registration District.—The boundaries of this district have been amended by Order in Council gazetted on the 21st December, 1922, and now stand as follows: All that area comprising the counties of Sounds, Marlborough, and Awatere as at present constituted, and including all boroughs and town districts in or adjacent to that area, together with D'Urville, Arapawa, and the other adjacent islands.

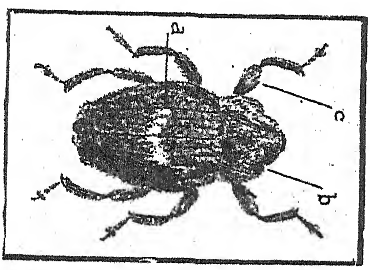
THE FIJI LEMON-WEEVIL (ELYTROTEINUS SUBTRUNCATUS FRM.).

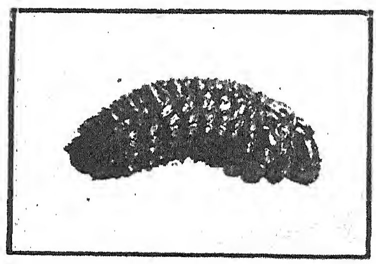
OCCURRENCE IN SOME RECENT IMPORTATIONS.

DAVID MILLER, Entomologist, Wellington.

Two consignments of lemons landed at Lyttelton in June last from the Cook Islands were found by Mr. W. K. Dallas, Orchard Instructor at Christchurch, to be infested by the larvæ of some weevil. Specimens of the infested lemons were forwarded to the Department's Biological Laboratory for determination, and the larvæ were successfully reared to the adult. Specimens were sent to Dr. G. A. K. Marshall, Director of the Imperial Bureau of Entomology, London, who identified them as *Elytroteinus subtruncatus* Frm.

This weevil was first recorded from Fiji in 1881, and recently was found at Honolulu infesting the roots of the white ginger-plant (*Hedychium coronarium*), the authorities, in consequence, prohibiting the transportation of this plant throughout the Hawaiian Territory. The weevil has not been recorded heretofore upon lemons.





FIJI LEMON-WEEVIL.

Fig. 1. Adult, × 3½ (after Marshall). Fig. 2. Larva, × 3.

The adult weevil (Fig. 1) measures about ¼ in. long; the general colour is chestnut-brown owing to the chestnut-brown vestiture, although only the ground-colour of the thorax is of this colour, that of the wing-cases being black, seen along the numerous lines or striæ which are destitute of vestiture. There are patches of snow-white vestiture on the upper surface of the body, and these are more distinct about the middle of the wing-cases, where they form a more or less distinct, transverse, slightly curved band (*a*). The posterior end of the wing-cases, which come well down over the sides of and curve slightly beneath the abdomen, is truncated, while the side margins of the thorax are notched just behind the head (*b*), the latter being practically concealed from above. On the under-side of the front femora is a distinct tooth (*c*). The snout or rostrum when at rest lies in a groove, which extends to between the articulation of the first pair of legs.

The larvæ (Fig. 2) are legless, of a creamy-white colour, with a distinct brown head, and measure about ½ in. long when full grown. They are rather plump, the head end of the body being narrower, and they rest usually with the body more or less doubled.

Observations made at the Laboratory and by Mr. Dallas showed that the fruit was attacked at the base of the stalk, the larva working its way through the peel and tissue lying immediately thereunder; the core was also found to be attacked. As far as was observed there was never more than a single larva in one fruit, and as the point of entrance was not discernible it is probable that the female punctured the base of the stalk and laid her egg therein. Pupation took place in the fruit, and if the latter decayed before the adult developed, its emergence was greatly hindered or even prevented.

COLLAR-ROT IN PEA CROPS ON THE WAIRAU PLAIN.

SOME CAUSES AND PREVENTIVE MEASURES.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Wellington.

CONSIDERABLE concern has been caused this season among farmers on the Wairau Plain, Marlborough, because of the failure of many of the pea crops, consequent upon the ravages of the Fusarium fungus disease commonly known as collar-rot. This disease begins by causing the stem to rot just above the crown. As it spreads it reaches the root, soon causing the latter to become a putrid mass. It also extends vertically up the stem, causing the leaves to wilt and the plant finally to die. Infection is conveyed through the medium of the seed and straw, but rarely through the soil. Early in November last I inspected a large number of crops in various parts of the Blenheim district, and found fully 90 per cent. of them to be infected with this disease. The chief varieties inspected were Dwarf, Medium Straw, and Partridge. Of these the Dwarf variety seemed to be suffering most seriously, while Medium Straw seemed to withstand the attacks of the disease better than did Partridge crops.

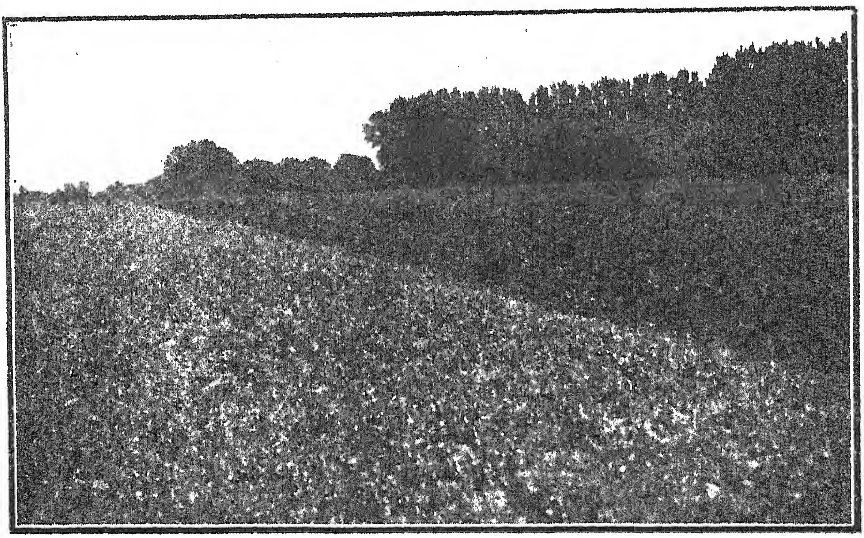
Probably Marlborough pea crops have been more or less affected with this disease for years, but it has become more pronounced than usual this season. Some of the reasons for its additional severity this year are fairly obvious:—

1. The warm humid weather which was experienced in the spring has favoured the growth of the fungus-spores.

2. In the Spring Creek district, where the disease is most pronounced, the worst failures are on badly drained and sour soils.

3. The practice of manuring a soil year after year with superphosphate alone has been prevalent among some of the farmers. This has had the effect of gradually exhausting the lime content of the soil. Through sour-soil conditions the plant has been so weakened as to be less able to withstand the attacks of the disease.

4. Soil-samples which were taken from the Dillon Point Road district two years ago showed on analysis that the lime content of many of the river-silt soils was running out. This is, of course, due to the farmer's cropping year after year, regardless of the relentless operation of the law of diminishing returns. Samples which were analysed this season from the Spring Creek district showed that a similar process was taking place. Some soils on the Wairau Plain are so plentifully supplied with lime as to have a negative lime requirement. On the other hand, the requirements of Spring Creek soils vary from 14 cwt. to 30 cwt. per acre. It is evident, however, that a deficiency of lime to the extent of 1 ton per acre would not alone be



PEA CROP (ON LEFT) AT SPRING CREEK THAT HAS SUCCUMBED TO COLLAR-ROT, ADJOINING HEALTHY CROP OF TARES.

[*Photo by J. M. Smith.*

responsible for the destruction of a pea crop by collar-rot. On Mr. F. W. Soper's property, at Spring Creek, the lime requirement of a paddock where a good crop of peas has been grown is exactly the same as another on which the pea crop has succumbed to the attacks of the fungus. One thing is particularly noticeable, and that is that the most glaring failures are produced upon the sourest soils. No doubt infection from the worst crops has rapidly spread, so that now peas are suffering from the disease in many cases irrespectively of the soils upon which they are grown.

5. Very sandy soils markedly deficient in humus, and hence poorly supplied with nitrogen, have usually suffered badly.

6. In cases where no attention has been given to proper rotation of crops the results have most frequently been disastrous. In one case the growing of peas after peas next to a crop where a proper rotation has been employed is most striking; in the former case the

crop hardly exists, while in the latter it is fairly good. Obviously, the remedy which most readily suggests itself is to employ a suitable rotation—say, wheat, oats, or barley, followed by temporary pasture, which might in turn be succeeded by a root crop before legumes are again grown. Tares, however, do not seem to be subject to the disease in question. At Mr. A. Gane's property, Spring Creek, a fine crop of tares has been produced in the same paddock as a crop of peas that has taken the disease badly. A careful inspection of the tare crop revealed no signs of disease. This season in the Blenheim district peas are being grown on contract at 5s. to 5s. 6d. per bushel, and tares at 8s. 6d. per bushel. As there is a good and fairly constant demand for tares, it should pay the Marlborough farmer to turn his attention in the future more than he has done in the past to the production of tare-seed.

THE APPLICATION OF LIME.

In a comparatively dry district such as that under consideration the advantages of a quick-acting manure like superphosphate are indisputable. There is every reason to believe, however, that the use of super after lime should yield equally good results. There are various rich lime-deposits in Marlborough. The most accessible, although not the richest, is that at Flaxbourne. This deposit is two miles from the Ward Railway-station, the road to the railway being quite good, and offering no obstacles to the easy transport of lime. The deposit, which is on Mr. A. Thompson's property, has now been worked for several years, the soft portion of the deposit being simply screened and supplied to the farmers at a moderate rate. The position now is that only some 300 tons more of the soft lime remain. After this is exhausted the hard limestone, which appears to be of a higher grade, will have to be crushed. Mr. Thompson, I understand, is willing to install a crushing plant, provided he can obtain orders for 1,000 tons for the first twelve months. No more reasonable proposition could be placed before the Marlborough farmers, and it behoves them to look to their own interests and to the future development of their richly endowed province.

It is certain that the present trouble with the pea crops, also the falling-off of certain of the lucerne crops, would have been greatly mitigated if lime had been applied where it was so obviously necessary.

PEAR-MIDGE PARASITE.

In order to secure, if possible, consignments of the pear-midge parasite for liberation in the midge-infested areas of New Zealand, the High Commissioner in London, at the request of the Department of Agriculture, communicated with the Director of the Imperial Bureau of Entomology. The outcome is that the honorary managing committee of the Bureau has voted the sum of £200 for the investigation of the parasite. This work is being carried out at the Rothamsted Experiment Station, Harpenden, Herts, and as soon as material is available arrangements will be made for a shipment of the parasites. The work of establishing the parasite in this country will be carried out by the Department of Agriculture.

COW-TESTING ASSOCIATION NOTES.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE testing of ordinary herd cows under the association system continues to increase in New Zealand from season to season. Dairy-farmers are appreciating to a greater extent the importance of this branch of work, and never before has cow-testing received such strong support independent of the assistance of the Department of Agriculture. Even yet, however, the percentage of the Dominion's dairy cows whose records are being authenticated is far below a desirable proportion.

INTERIM STATISTICS REGARDING SCOPE.

It is still too early to give definite figures of all cows under test this season, data from privately conducted associations being still incomplete. The following particulars, however, will be of interest to *Journal* readers :—

For the season 1921–22 officers of the Dairy Division controlled some 50 associations, representing 23,326 cows owned by 1,053 members. This year the Division is conducting 55 associations, comprising 25,737 cows and 1,163 members, an increase of 5 associations, 110 herds, and 2,411 cows.

To date we have received figures for some 14 associations which have been newly formed this season. Of these, 10 are controlled by officers of the Dairy Division, and a total of 166 herds and 4,214 cows are represented.

So far figures for some 68 associations, including 1,478 herds and 32,875 cows, have been received at this office, and it is anticipated that complete figures will show a considerable increase over the number of cows previously tested.

EXAMPLES OF DEVELOPMENT.

Some noteworthy increases in association membership have come under notice. The Kia-ora Association, for instance, had 12 members for the season 1920–21, 22 members for 1921–22, and 56 are testing this year. Hokianga increased from 22 members last season to 57 this season, Kaipara from 22 to 56, and North Canterbury from 32 to 43.

An outstanding example of development is that of the Kaitieke Association. In September, 1920, the Kaitieke Co-operative Dairy Company took over the services of Mr. W. G. Batt, one of the Department's Dairy Instructors, and, apart from his work as Farm Dairy Instructor, he energetically took up the matter of forming a cow-testing association. The annual summary for Mr. Batt's first year included 47 members ; the second year it rose to 77 ; and this year there are, up to the time of writing, no less than 126 members, with 2,580 cows. The company has very wisely allowed every facility for the extension of the cow-testing association connected with it, realizing that higher production means more raw material, and therefore reduces manufacturing-costs.

(To be continued.)

VINE-CULTURE UNDER GLASS.

(Continued.)

W. H. TAYLOR, Horticulturist, Wellington.

The Second Swelling and Colouring.

THINNING the berries is, as far as possible, completed in one operation. This, however, is only accomplished by those who are experienced in the work and who know what the vines they are working on are capable of doing, as well as the size of berry to expect on different varieties. At least twice as many berries must be removed from Gros Colman as from Black Hamburgh. Inexperienced people usually underthin, with the result that the berries soon crush together, rendering a second thinning necessary. In a ripe bunch the berries should touch each other without crushing. A bunch when cut and placed on a dish should retain its shape. The exercise of judgment, backed by experience, is necessary to secure this condition. If the berries crowd together, and the bunches have a stiff unyielding appearance when the second swelling begins, more berries should be taken out or the bunches will be spoiled. The thinning should be completed before stoning is complete, but is better done late than not at all.

Soon after the second swelling begins the skin of the berries assumes a different appearance: it looks more transparent, a sign that ripening has commenced. The greatest increase in size is made during this period, swelling continuing until colouring is nearly finished. On this account the border should not be allowed to become dry. Watering, when necessary, may be freely done until the berries are half-coloured. By the time stoning is complete and the second swelling commences the condition of the whole vine will have changed: the laterals will have become woody and the leaves firm. If the conditions in the house are as they should be there will be no further danger from mildew. The state of a vinery should be naturally dry. Atmospheric moisture can then be increased when desirable, and during rainy weather there will not be too much dampness. During fine weather what is termed a buoyant atmosphere should be maintained—that is, the air should not be dry. Damping down may be necessary, but this is a matter for the exercise of judgment; some houses do not require it. Syringing the vines at this period is useful in keeping down red spider. Syringing does not injure the bloom on the berries, though it is commonly said to do so; it may be continued till colouring is well advanced.

During the ripening-period great care should be taken not to interfere with the respiratory system of the vines. If at this time any great amount of foliage is removed it causes a check in the development of the fruit. This emphasizes the necessity for timely attention to stopping or checking surplus growth before it has developed to a wasteful extent, so as to foster the main leaves, which are of the greatest importance, and secure a free passage for air.

A good canopy of foliage above the fruit is required, but not in a crowded condition. If, through neglect, there is at this time more lateral growth than there should be, such growth should be left till the grapes are ripe before cutting it out. In the meantime pinch off the points to prevent them advancing farther.

The After-ripening Period.

This is an anxious time to many growers of Gros Colman, the berries of this variety often cracking badly; it is not an uncommon experience to lose the greater part of the crop from this cause. Madresfield Court, a muscat variety, is subject to the same trouble. This variety, however, is not extensively grown in New Zealand. It is not necessary to here enter into details concerning the common opinion as to the cause of the cracking, as the theory supporting it has been proved to be wrong. The real cause is that the skin of the berry of these two varieties is peculiar and different from that of others, being very porous and able to absorb a considerable amount of water. Thus when the atmosphere of the house is surcharged with moisture, as may occur during wet weather, the berries absorb water, but, as the skin is not able to stretch any more, ruptures are caused. The remedy is to prevent, by judicious ventilation, anything like a still atmosphere about the berries. Some amount of top ventilation should always be on, by night as well as by day. A still further reason for a proper control of lateral growths is here provided, for if the foliage is crowded the difficulty of keeping the air moving will be greatly increased.

These conditions of ventilation are also suitable for keeping grapes of other varieties after they are ripe. Absolutely dry conditions should be avoided or the berries will not remain plump. In a very dry house a little damping down is advisable. In this matter, however, treatment right in one place would be wrong in another: every house should be treated in accordance with its condition.

Regarding late lateral growth, some growers think this should be allowed to run free. In my opinion such a course is wrong, as it tends to keep the vines active too long. This growth should be checked as before, and the vines encouraged to go to rest, because the resting-period is very short in this country whatever may be done.

Manuring established Vines.

The manurial requirements of grape-vines are practically the same as those of most fruit-trees, but as the vines are planted close together, resulting in the soil being heavily taxed, manuring must be on a much more liberal scale than in the case of orchard trees. The principal elements necessary are phosphates, potash, nitrogen, and lime, just the same as are required for most other fruits and general crops. In the case of grape-vines, where liberal quantities are used, it is necessary to be careful that some of the elements in the case of both artificial and organic manures are not used in excess. A proper balance is necessary to secure the best results and to avoid danger.

Lime is of great importance; it corrects acidity, liberates potash, increases the activity of nitrogen bacteria, and is required as plant-food. Cases of bad setting and of stoneless berries have been traced to

a lack of lime. Potash is also of great importance. The most useful artificial potassic fertilizer for vines is sulphate of potash. Animal-manures contain some amount of potash, and wood-ashes a good deal, though the amount is variable. The chief artificial phosphates are bonedust and superphosphate; the former is generally preferred for vines. The principal nitrogenous fertilizers are nitrate of soda and sulphate of ammonia, the former for quick effect, the latter for more gradual use throughout the growing season.

Stable manure is considered a complete fertilizer. It is rather weak in potash, and may contain only a small amount of nitrogen. It is a mistake to apply heavy quantities to the borders; this results in souring the soil, and cases are known where vines have been killed by it. Used in a moderate way, and with a sufficiency of lime, good crops can and have been grown with no other fertilizer. Better results can usually be secured, however, by supplementing stable manure with artificials. Cow-manure has been used with good results where the soil is light and warm. It should be used with caution on borders with heavy soil, as it is liable to seal up the soil and make it sticky.

The growth of vines in different soils and circumstances varies greatly in character. Where growth is very strong much nitrogen in the fertilizer will not be wanted. On the other hand, if growth is weak, or comparatively so, an extra amount of nitrogen, preferably in the form of nitrate of soda, should be given. The role of nitrogen is to promote vegetative growth; it does this only when a sufficiency of the other elements is present.

Following is an outline of the practice of manuring suitable for general use: After the vines have been pruned the border should be cleaned up. If a summer mulch has been applied any strawy debris should be removed. If weeds are present, clear them off. The surface of the border should not be dug, using the term in its ordinary sense, but it may be lightly pointed over with a fork. If the soil is destitute of lime give 2 lb. of air-slaked quicklime per square yard, mixing it well with the surface soil. If lime has been applied not more than two years before, ½ lb. per square yard will be sufficient, while if given regularly every year 4 oz. per yard will be enough. A month or three weeks before the vines start new growth a fertilizer consisting of bonedust 2 oz., sulphate of potash 1 oz., and sulphate of ammonia 1 oz., each per square yard, should be applied, and scratched in with a sharp-toothed rake. Just before the vines begin to flower apply nitrate of soda, 1 oz. per square yard.

Prior to the setting of the berries the surface of the border should be open to the sun. On the other hand, if some protection against sun and wind is not provided during summer the surface soil becomes dried up and the roots go down deep in search of moisture, which is very undesirable. Therefore, when the berries have set, a mulch should be applied. Rather fresh and littery stable manure is the best material; a coat about 6 in. thick may be given. The fertilizing properties in the manure will be washed in by rain or by watering, and no other fertilizer will be wanted. Failing manure, repeat the early dressing of sulphate of potash, and add blood-and-bone, 8 oz. per square yard. A mulch of some kind should be provided: this may be spent hops, straw, or any suitable material that is available.

Watering.

The grape-vine is a vigorous plant, and is expected to carry a fairly heavy crop of soft fruit which contains a good deal of water. If the vines are flourishing, the border will be full of roots, and a liberal supply of water must be assured. Outside borders rarely require watering till the stoning-period is past, and with inside borders watering should be of a minimum character during the stoning-period. It is after this time that the demand for water is greatest. When it is applied it should be in volume sufficient to penetrate the whole of the border. There is no danger of overwatering, provided drainage is good. If drainage is not good it is a defect that should be remedied the following winter. A thorough watering twice a week is sufficient for dry situations. It is a matter for which no hard-and-fast rule can be laid down ; each grower must be guided by his own circumstances. Applications of liquid manure are advisable if the vines lack vigour. These should precede watering, so that the manurial properties may be washed down to the roots.

VARIETIES.

The appended list is confined to those varieties already in cultivation in this country that have given general satisfaction and can be most strongly recommended. It is not suggested that no other varieties are worth growing, but it is claimed that the varieties mentioned supply all purposes, and that any addition will be merely a matter of interest in varieties. The greater part of commercial crops is composed of two varieties—Black Hamburgh and Gros Colman. These two are without doubt the best varieties that can be selected, although occasionally a small proportion of other varieties is grown. In some cases, where the vinery is close to a large population, the crop is mostly disposed of direct to customers. In these cases it seems to pay to grow varieties of superior flavour, which, though not producing so heavy a crop, command a higher price, and, further, serve to popularize the establishment. Muscat Hamburgh, West's St. Peters, Mrs. Pince, and Muscat of Alexandria are among the best that can be grown for this purpose. The public taste in this country is for black grapes ; there is little demand for white varieties. In private establishments white varieties are usually (and quite rightly) included, as this adds variety and interest to the supply.

Black Varieties.

Black Hamburgh : This is the most popular and most widely grown of all varieties. It does well in any form in which grapes are grown—in a cool or a warm house. Bunches and berries are handsome, and flavour excellent. It is to be understood that cultivation, regulation of the crop to the capacity of the vine, and general management influence the finish and consequent appearance and flavour of the berries. This does not, however, sufficiently account for the distinct shape of berries on different vines of Black Hamburgh, sometimes in the same house. The fact is, there are two varieties grown indiscriminately under one name. The variety most extensively grown is the Frankenthal Hamburgh, which is commonly known as Black

Hamburgh. It has numerous synonyms—Frankenthal, Frankenthal Hamburgh, Hampton Court Hamburgh, Black Tripoli, and others. The berries are roundish-oval or nearly oval.

Mill Hill Hamburgh : This variety is also known as Black Champion and Champion Hamburgh. It is distinguished from the former by having very strong laterals, while the berries are much larger, and when properly ripened have a hammered appearance. It is regarded as the most noble of the sweet-water grapes. Vines of this variety are fairly plentiful in New Zealand, grown as Black Hamburgh, the name being common to the two varieties.

Gros Colman : A thick-skinned vinous grape ; berries very large and round, and should be jet-black when ripe. Flavour rather poor when first ripe ; after hanging it becomes vinous and agreeable. In this country Gros Colman is the most extensively grown variety for late use.

Gros Maroc : A very handsome grape when well grown. Berries ovate, very large, pleasantly flavoured, and vinous. Ripens soon after Black Hamburgh and succeeds in the same conditions.

Madresfield Court : A muscat, with handsome bunches ; large berries of rich flavour. Does not hang well, being liable to crack and to lose colour.

Muscat Hamburgh (synonym, Snow's Muscat) : An oval-berried muscat with rich flavour. Does well grown with Black Hamburgh ; ripens soon after that variety. Does not hang long after it is ripe. Not a commercial variety, but private vineries should include a rod or two.

West's St. Peters : A first-class late grape of the vinous class. Specially recommended for invalids, the fruit being very refreshing. Berries roundish-oval, medium size ; skin very thin.

Mrs. Pince : A high-class late muscat. Berries medium size, oval or oblong. Skin thick and tough ; flesh firm, crackling, vinous, and rich, with a fine muscat flavour. An excellent keeper, though apt to shrivel and lose colour. Requires a warm house.

White Varieties.

Duke of Buccleugh : The most handsome of the white sweet-water grapes. Bunches large ; berries large, roundish-oval, colouring a rich amber. Ripens slightly before Black Hamburgh, with which variety it can be grown, but it should be in the warmest part of the house.

Muscat of Alexandria : Considered to be the finest-flavoured of all grapes. The oval berries should be golden-amber when ripe. Requires a warm house, and is very much affected by unsuitable conditions at root or top. Does fairly well in unheated houses in this country.

Mrs. Pearson : A round-berried muscat of first-class quality. Late, keeps well, and easy to grow.

Pearson's Golden Queen : A vinous grape ; berries above medium size, oval ; bunches handsome. A good variety that does well in most places. Season late ; hangs fairly well.

(To be continued.)

TESTING OF PUREBRED DAIRY COWS.

DECEMBER CERTIFICATE-OF-RECORD LIST.

THE following list, comprising the records of cows which qualified for certificates during December, 1922, is supplied by the Director of the Dairy Division, Mr. W. M. Singleton:—

LIST OF RECORDS.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Dominion Pride of Weraroa	Central Development Farm, Weraroa	2 78	248·3	365	15,686·2	511·63
Cordyline Betsy de Kol	James Dow, jun., Outram	2 47	245·2	354	13,725·6	501·00
Wyndham Morpeth Countess	Gibb Bros., Clifton ..	2 32	243·7	365	11,705·75	471·50
Bloomfield Netherland May	Bloomfield Farm Company, Wellington	1 352	240·5	365	11,266·7	459·79
Tokaora Alcartra ..	H. E. Johnson, Tokaora	2 46	245·1	356	13,703·9	430·20
Tokaora Lassie ..	H. E. Johnson, Tokaora	1 363	240·5	365	13,530·2	419·33
Colinton Lorna ..	R. Colee, Greendale ..	2 14	241·9	340	10,212·9	410·36
Martha Pauline Veritas	W. Barton, Featherston	2 95	250·0	364	14,201·7	404·98
Bloomfield Peace de Kol	Bloomfield Farm Company, Wellington	1 353	240·5	365	13,111·0	393·71
Longview Adeline Segis	C. R. Duncan and Sons, Whangamarino	2 24	242·9	365	9,410·2	361·61
Colinton Polly ..	R. Colee, Greendale	1 284	240·5	365	10,143·2	340·02
Dominion Olgapatch	Central Development Farm, Weraroa	2 54	245·9	365	9,826·4	331·13
Paul's Princess of Braystone	Knight and Sons, Ongarue	2 91	249·6	310	8,558·5	328·12
Ashlea Grace Pietertje Pontiac	R. Colee, Greendale ..	1 340	240·5	321	9,260·6	320·47
Ashlynn 70th ..	Piri Land Company, Auckland	1 361	240·5	365	7,910·7	315·30
Fairview Black Spot	Mrs. T. E. F. Hardwick, Kennington	1 216	240·5	360	9,582·9	309·16
Konini Startle 3rd ..	R. Colee, Greendale ..	1 332	240·5	232	7,354·7	255·95
Senior Two-year-old.						
Martha Johanna Elgin	W. Barton, Featherston	2 296	270·1	362	13,833·4	430·65
Ashlynn 34th ..	Piri Land Company, Auckland	2 342	274·7	365	9,961·3	396·02
Oaklea Segis Bonnie	Knight and Sons, Ongarue	2 270	267·5	310	8,553·9	325·86
Junior Three-year-old.						
Cordyline Colantha Cremona	George Aitchison, Kaitangata	3 26	279·6	328	14,898·0	576·00
Ryvington Quick ..	Estate of T. O. Hodgson (deceased), Tamahere	3 37	280·7	365	14,255·8	555·34

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS—*continued.*				
Senior Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Medbury Woodcrest Domino Maid	H. Johnson, Stratford	3 286	305·6	337	13,625·0	551·66
Colinton Tui ..	R. Colee, Greendale ..	3 337	310·7	365	11,051·4	468·93
Junior Four-year-old.						
Bainfield No. 16 ..	W. D. Hunt, Invercargill	4 127	326·2	365	20,917·5	728·13
Ashlynn Mag ..	Piri Land Company, Auckland	4 107	324·2	365	15,206·5	489·44
Fairview Nellie Segis	Mrs. T. E. F. Hardwick, Kennington	4 36	317·1	326	12,631·2	409·07
Senior Four-year-old.						
Carlowrie Maid ..	R. K. Macdonald, Edendale	4 346	348·1	365	17,454·5	542·77
Mature.						
Dominion Olga 2nd..	Central Development Farm, Weraroa	5 194	350·0	346	15,539·7	568·02
Ongarue Netherland	Knight and Sons, Ongarue	5 46	350·0	341	16,148·3	553·01
Waihou Queen ..	Cameron Bros., Stratford	8 47	350·0	317	15,233·9	519·76
Carlowrie Princess Domino	R. K. Macdonald, Edendale	5 243	350·0	365	15,425·5	500·17
Riverlea Maudie de Kol	Knight and Sons, Ongarue	7 280	350·0	353	12,083·2	445·82
Colantha La Favourite	Marchant and Sons, Cardiff	7 51	350·0	183	13,733·8	443·05
Dominion Imarose ..	Gibb Bros., Clifton ..	5 0	350·0	334	13,104·0	412·88
Dominion Domino's Dutch Girl	Central Development Farm, Weraroa	6 59	350·0	306	11,717·9	364·16
		JERSEYS.				
Junior Two-year-old.						
Princess of Rosy Creek	A. and J. O'Donnell, Hawera	2 87	249·2	365	9,018·8	554·90
Oakland's Belle Mahone	F. W. Cornwall, Bell Block	2 83	248·8	365	8,564·8	553·22
Charm's Clematis ..	J. O'Donnell, Bunnythorpe	1 348	240·5	365	8,696·7	506·81
Holly Oaks Pretty ..	H. H. Sutton and Co., Masterton	2 56	246·1	365	8,788·0	500·09
Fern's Golden Princess	H. H. Sutton and Co., Masterton	1 282	240·5	365	8,376·7	483·18
Viola's Golden Fern	R. Cobbe, Feilding ..	2 48	245·3	348	7,948·9	470·65
Viola's Queen Bess ..	R. Cobbe, Feilding ..	1 293	240·5	365	7,016·3	460·32
Violet's Gem ..	G. Hodgson, Whakapara	1 290	240·5	343	7,513·9	458·33
Falconite's Joy ..	T. Pollock, jun., Pukekohe	2 57	246·2	365	9,843·2	450·34
Lady Celia ..	E. Joyce, Kaponga ..	1 227	240·5	345	7,103·0	446·20
Eileen Silverskin ..	F. V. Bryant, Ruawhata	1 301	240·5	365	9,571·9	445·64

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Woodlands Gipsy ..	H. C. Sampson, Hillsborough	1 339	240·5	365	7,202·3	440·25
Daphne Renown ..	F. V. Bryant, Ruawhata	2 23	242·8	354	7,871·5	438·75
Irene's Goldie ..	A. Buchanan, Palmerston North	1 362	240·5	365	7,722·1	435·48
Rosa's Ripple ..	A. Buchanan, Palmerston North	2 68	247·3	347	7,315·0	427·51
Rewa Facility ..	D. Wishart, jun., Ryal Bush	2 2	240·7	365	7,527·2	426·72
Woodstock's Midget	A. Banks and Son, Kiwitea	2 19	242·4	365	8,685·5	417·77
Golden Aureola ..	F. Gough, Awakeri ..	1 334	240·5	365	7,982·3	416·50
Rewa Queen ..	W. H. Hall, Carterton	2 6	241·1	365	8,469·7	403·46
Meon Avis	C. H. Weston, New Plymouth	2 1	240·6	363	6,446·4	384·60
Meon Aster ..	C. H. Weston, New Plymouth	1 351	240·5	365	6,692·0	354·28
Poplarvale Chetnol Bud	R. C. Henry, Bell Block	2 24	242·9	365	5,596·8	350·70
Conqueror's Clematis	H. R. Benbow, Ormondville	2 41	244·6	329	6,219·8	349·96
Physalis	R. C. Henry, Bell Block	1 357	240·5	365	5,266·2	335·33
Kudos Doreen ..	E. Harding, Woodville	1 334	240·5	347	5,326·5	314·69
Senior Two-year-old.						
Silver Buttercup ..	H. H. Sutton and Co., Masterton	2 236	274·1	365	9,412·7	513·44
Treasure's Patch ..	H. H. Sutton and Co., Masterton	2 104	250·9	365	9,769·5	501·43
Winter Nellis ..	H. H. Sutton and Co., Masterton	2 147	255·2	365	8,520·0	496·18
Woodstock's Spright	A. Banks and Son., Kiwitea	2 314	271·9	365	9,527·6	471·92
Sweetest Joy ..	Mrs. M. A. Rogers, Katikati	2 294	269·9	342	6,788·9	377·78
Woodstock's Floss ..	A. Banks and Son, Kiwitea	2 353	275·8	296	6,312·5	340·71
Thistle of Bull's ..	F. J. Watson, Bull's ..	2 201	260·6	365	5,302·0	328·56
Three-year-old.						
Lucretia	H. R. Benbow, Ormondville	3 352	312·2	365	8,826·7	515·09
Sunny Meadows Fantail	F. J. Wyatt, Towai ..	3 38	280·8	365	7,539·8	505·04
Woodstock's Fairy ..	A. Banks and Son, Kiwitea	3 46	281·6	365	9,090·6	490·49
Aratika Varna ..	D. Kennedy, Morven	3 38	280·8	365	8,222·0	476·42
Woodstock's Bright Eye	A. Banks and Son, Kiwitea	3 359	312·9	365	6,987·3	455·32
Coronet	D. L. A. Astbury, Mangatoki	3 301	307·1	365	7,898·3	446·86
Worksop Silver Thread	J. W. Beagley, Woodville	3 68	283·8	364	7,428·7	404·85
Waipiko Priscilla ..	J. C. Hare, Cheltenham	3 13	278·3	365	8,257·0	404·45
Majesty's Orange Fox	R. R. Dean, Te Kuiti	3 16	278·6	261	7,037·3	355·82

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
		JERSEYS—*continued.*					
Four-year-old.		Yrs.	dys.	lb.		lb.	lb.
Butter Boy's Flower	E. Joyce, Kaponga ..	4	13	314·8	364	8,191·6	523·99
Undean's Star Lady	J. Fulton, Whangarata	4	20	315·5	365	9,769·7	520·68
Woodstock's Fanatic	A. Banks and Son, Kiwitea	4	88	332·3	326	9,433·3	492·12
Golden Fern's Queen	R. Cobbe, Feilding ..	4	350	348·5	315	9,390·0	466·11
Mature.							
Ngatina	F. C. Starck, Normanby	5	31	350·0	365	12,939·9	718·59
Chelsea Flower ..	Thos. Church, Te Rapa	8	71	350·0	365	12,296·1	708·45
Charming Irene ..	C. Stevens, Maungatapere	6	257	350·0	357	12,042·0	702·67
Buttermilk ..	H. B. Lepper, Lepperton	9	29	350·0	365	10,720·75	660·95
Flossie Deem ..	T. Pollock, jun., Pukekohe	7	63	350·0	365	15,728·0	643·65
Agatha	C. Stevens, Maungatapere	7	327	350·0	350	10,204·3	594·50
Signal's Queen ..	John Hale, New Plymouth	9	64	350·0	365	11,991·5	588·79
Lady Joyful ..	C. Stevens, Maungatapere	6	252	350·0	365	10,478·7	569·90
Woodstock's Baby ..	A. Banks and Son, Kiwitea	7	18	350·0	365	10,980·5	540·46
Lucy Grey	G. Hodgson, Whakapara	6	346	350·0	365	9,620·2	537·77
Reid Park's Queen ..	G. Bright, Otaua ..	6	99	350·0	310	8,091·1	484·17
Golden Floss ..	A. Banks and Son, Kiwitea	8	343	350·0	365	11,336·1	475·23
Ana	K. M. Stevens, Maungatapere	8	3	350·0	356	8,742·8	469·66
Woodruffe	F. J. Saxby, Ohaupo ..	15	276	350·0	365	8,627·9	436·01
Rewa Maize ..	H. Stonex, Bell Block	5	66	350·0	365	7,526·0	425·76
Edgely Noble Lily ..	S. R. Lancaster, Palmerston North	6	137	350·0	365	8,056·75	408·42
		MILKING SHORTHORNS.					
Junior Two-year-old.							
Newstead Daphne ..	Samuel Lye, Newstead	2	31	243·6	365	9,771·1	376·24
Newstead Rebecca ..	Samuel Lye, Newstead	2	0	240·5	365	8,566·0	366·12
Newstead May ..	Samuel Lye, Newstead	1	339	240·5	362	8,112·7	329·37
Newstead Jean ..	Samuel Lye, Newstead	2	54	245·9	358	7,324·9	314·88
Newstead Dairymaid	Samuel Lye, Newstead	2	22	242·7	333	5,917·5	256·57
Newstead Gem ..	Samuel Lye, Newstead	1	351	240·5	365	6,396·0	242·43
Senior Two-year-old.							
Dominion Armistice of Ruakura	Ruakura Farm of Instruction, Hamilton	2	318	272·3	320	9,259·7	342·13
Dominion Bianca of Ruakura	Ruakura Farm of Instruction, Hamilton	2	285	269·0	344	8,465·1	327·06
Junior Three-year-old.							
Dominion Carnation of Ruakura	Ruakura Farm of Instruction, Hamilton	3	9	277·9	348	9,942·6	439·20
Dominion Attraction of Ruakura	Ruakura Farm of Instruction, Hamilton	3	11	278·1	344	10,222·3	409·84
Newington, Jean ..	Samuel Lye, Newstead	3	0	277·0	298	9,192·5	356·18
Senior Three-year-old.							
Matangi Cherry 1st ..	Ranstead Bros., Matangi	3	345	311·5	351	8,419·6	360·77

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	MILKING SHORTHORNS—*continued*.					
		Yrs. dys.	lb.		lb.	lb.
Junior Four-year-old.						
Cloverlea Harriett 4th	D. Buick, Palmerston North	4 143	327·8	334	10,651·6	410·31
Cloverlea Harriett 2nd	D. Buick, Palmerston North	4 27	316·2	346	8,480·8	325·97
Mature.						
Studleigh Nancy Lee	D. Buick, Palmerston North	7 257	350·0	365	17,177·5	623·37
Sunnyside Beauty 4th	Sunnyside Mental Hospital	6 37	350·0	354	11,398·2	406·27
Braeburn Cherry ..	Samuel Lye, Newstead	..	350·0	365	9,913·0	424·44
Daphne 6th	G. H. Hadfield, Paraparaumu	10 164	350·0	332	8,983·1	379·83
Aloe 18th	Samuel Lye, Newstead	8 39	350·0	292	10,186·5	357·68
	AYRSHIRES.					
Three-year-old.						
Dominion Cherry Bloom	Moumahaki Experimental Farm, Waverley	3 342	311·2	298	9,698·0	338·89
Heather Bell of Elmwood	C. B. Morgan, Ngawapurua	3 33	280·3	365	7,577·4	334·08
Four-year-old.						
Greenfields Lassie ..	C. E. C. Webb, Koputaroa	4 325	345·5	365	12,095·7	473·56
Mature.						
Greenfields Mary ..	C. E. C. Webb, Koputaroa	5 339	350·0	365	12,834·8	534·20
Dominion Cherry 1st	Moumahaki Experimental Farm, Waverley	6 113	350·0	327	11,314·2	449·37

Second-class Certificates.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.						
Silverley's Ambition	J. S. Jones, Bell Block	1 302	240·5	365	6,088·5	381·62
Four-year-old.						
Madam Bush Nora ..	F. J. Saxby, Ohaupo	4 282	341·7	365	9,464·0	507·38
La Pisa	O. Monrad, Palmerston North	4 31	316·6	360	9,232·35	459·12
Mature.						
Silver Pride ..	J. S. Rae, Tancatua ..	5 262	350·0	364	7,668·0	448·81
Fortuna's Rosy ..	S. R. Lancaster, Palmerston North	5 81	350·0	365	7,340·5	434·13
	FRIESIANS.					
Junior Two-year-old.						
Eve Beauty ..	R. Colee, Greendale ..	2 36	244·1	365	7,713·5	320·57
Senior Three-year-old.						
Ardmore Plum 3rd ..	W. Potter, Mangere ..	3 330	310·0	364	12,268·7	424·28
Mature.						
Quickshine ..	H. E. Johnson, Tokaora	6 4	350·0	365	18,639·0	593·87

SEASONAL NOTES.

THE FARM.

FIELD CROPS AND PASTURES.

Cereal Harvest.

HARVEST operations will be continued in most districts during February. In some parts threshing from the stook is practised, but unless the weather is very settled it is much safer to stack the material. When grain is stacked it sweats more or less, and here judgment is required if the grain is to be saved in the best of condition. It should either be threshed at once or allowed to lie in stack a sufficient length of time for the grain to harden after the sweat, about a month being the minimum.

The oat crop, which plays such an important part in the farming practice of south Otago and Southland, will, by the beginning of the month in many parts of those districts, be ready for cutting. This operation is best commenced when there is a considerable amount of green tinge on the ear, as the crop ripens considerably when standing in the stook. Any loss which may occur from cutting too green is practically negligible when compared with what generally happens from shedding before reaping is finished, in the case of overripeness.

Catch-crops.

Green crops for autumn and winter feeding—such as barley, oats, or wheat, or one of these cereals in conjunction with tares or crimson clover—may be sown towards the end of February. If very quick feed is required, Black Skinless barley will be found the best, but where the feed is required during the winter and early spring Algerian oats will probably give better results. Where crimson clover is to be used in conjunction with a cereal the latter should be drilled in at the rate of 2 bushels per acre, and the crimson-clover seed then broadcasted at the rate of 10 lb. per acre and rolled in. A mixture of this sort will provide good feeding late into the spring; but where convenient it is good practice to feed until August, then let the clover come away for a few weeks and turn it under as green manure. Here, again, the farmer will have to be guided by the subsequent use he intends to make of the land.

Autumn-sown Grass.

Where it is intended to sow down autumn grass the ground for that purpose should be broken up and prepared in readiness for sowing. It is highly desirable to carry out this operation as early as possible, in order that the dry soil and hot sun usually experienced in February may kill out weeds, leaving the paddock more or less clean. Then when the autumn rains arrive and fall upon the warm ground ideal conditions are given for the establishment of the pasture. Too often one observes farmers endeavouring to sow fine grass-seed on badly prepared, rough, bumpy ground, and, as is to be expected, a poor strike is usually the result. A fine tilth is necessary if a good close sward is to be formed, and the aim should be to obtain a good germination, thus preventing the intrusion of deleterious weeds. When a pasture is expected to last for several years it pays to give it every chance, and a reasonable amount of fertilizer applied with the seed will more than return the initial expenditure.

The constitution of the grass-seed mixtures should receive careful consideration. One of the great weaknesses of much of our permanent pasture is the small amount of cocksfoot and red clover appearing in it, and thus it provides little autumn feed. If a liberal amount of cocksfoot is sown, the perennial rye-grass in the mixture should be considerably reduced to allow of the establishment of the cocksfoot. An excellent temporary pasture, affording an abundance of good succulent food in the early spring, may be obtained by sowing down in February or March a mixture of, say, 25 lb. of Western Wolths rye-grass and 4 lb. alsike clover. A corresponding mixture of Italian rye-grass and red clover is a good alternative.

Turnips and Potatoes.

Turnip crops may be thinned during the coming month. The most economical way of doing this is to run the harrows lightly across the field. As regards cultivation, by giving a scuffling during February moisture is conserved in the soil just at the time when the crop usually suffers most from the lack of it.

In the later districts potatoes should be given their last cultivation. This being essentially a cleaning crop, it pays to keep the cultivator going as long as possible. Preparations should be made for saving seed from the main crops. Only those tubers free from disease should be selected, and although the storage of immature seed is not always easily accomplished such seed usually gives the best results. Medium-sized seed about the size of a hen's egg is the most suitable.

Lucerne.

February is a good month for destroying weeds and grass in dirty stands of lucerne. As the lucerne is cut the land should be cultivated. If clean, a stroke of the tine harrows to keep the soil free is all that is required; but if dirty, stronger methods must be adopted. Young lucerne crops sown in November and December should be ready for cutting about the end of February, and will greatly benefit by a cultivation to keep the land free and destroy weeds. Under Canterbury conditions it is generally found economical to graze the last growth of established stands of lucerne. As a haying proposition the cut is so light that it does not pay for working-expenses. As soon as growth ceases, the land should be stirred with the grubber.

If the weather is seasonable February is generally a favourable period for sowing lucerne. Compared with spring sowing, more time is available for destroying weeds, and there is less likelihood of a cold wet spell of weather following closely on the germination of the lucerne-seed and so checking the growth of the young plants. A frequent mistake in lucerne-culture is that of sowing too deeply. Very often one sees the ordinary tine harrows being used for this purpose, with the result that a large proportion of the seed is buried. A light brush harrow, or one made from strips of wire netting laced together and weighted at the end with bolts, will be found more satisfactory for covering the seed.

As regards irrigated areas, it is important to bear in mind that sowing should follow irrigation, and not *vice versa*, otherwise the ground will be left in a cold damp condition unsuitable for the germination of the seed.

Feeding of Dairy Cows.

Supplementary green feeding of dairy stock will now be fairly general, and where such crops as lucerne and maize have been provided in conjunction with soft turnips, the fodder should be carted out during the day into different fields. The cows could then have the lucerne or maize for an evening meal after milking, and the turnips after the morning milking. It is difficult to lay down definite quantities, but from 40 lb. to 60 lb. of turnips may be given daily, and as much maize or lucerne as the stock will clean up nicely. Much depends on the condition of the pastures, and the farmer must use his own judgment.

Noxious Weeds.

Clearing of noxious weeds should be continued. Californian thistle will be flowering in many districts, and cutting should be carried out before the seeds are distributed broadcast by the wind. The second growth of ragwort will also require attention, and the flower-heads of this weed must be dealt with.

—*Agricultural Instruction Service.*

FAT-LAMB BREEDING: THE DOWNS AND DOWN CROSSES.

The question often arises, which breed of sheep is best for fat-lamb production? The present time, when many farmers are considering the purchase of rams and breeding arrangements generally, may be opportune for a few notes on the subject.

Points and characteristics which it is essential that any breed should possess before it could be termed the best for the purpose in question are squareness and compactness of frame; well-barrelled ribs; very full hind quarters, with the meat

coming well down on the legs, thus leaving only a short shank; and the quality enabling a large proportion to be sold straight off the ewes. We have in the Dominion four of the leading Down breeds, whose special feature is meat-production—easy and quick fattening, and the production of a large percentage of milk lambs. These breeds are the Southdown, Shropshire Down, Suffolk Down, and Dorset Down. Each of the Down breeds has distinctive markings.

The Southdown markings are tan-coloured spots on the face, and most of the hair on the lower part of the legs is of the same colour. This breed is often referred to as "blackfaces," but the term is wrongly applied, as the breed with the black face proper is the Suffolk. The Southdown breed complies with all that is required for mutton or the fat-lamb trade. The body is square, compact, and set close to the ground. The bone is light, and the leg of mutton ideal. It has been found repeatedly that the Southdown is the quickest to come to hand for market, and that land will carry more head per acre than with most of the other breeds. It is ready a fortnight to three weeks earlier (the saving of that amount of feed alone being an important point, more especially if the season is a dry one), and a very large percentage of the lambs can be sold direct off the ewes.

Then, there are the first-cross lines produced by mating Southdown rams with other ewes. The cross produced from the Southdown ram on either Corriedale or half-bred ewes is an excellent, good-selling line. The lambs fatten quickly, and the meat is fine in the grain and of sweet flavour. In the North Island large numbers of Southdown rams are used for mating with Romney ewes. The line produced is a good one and always in demand. The Southdown ram is also used with other lines of ewes for producing fat lambs, but it is noticed that the coarser-wooled the breed of ewe used, the longer the lamb takes in being got ready for market on the same class of feed. The number of Southdown rams in the North Island, as shown by the 1922 sheep returns, is 18,584, and in the South Island 2,329, making a total of 20,913 for the Dominion.

The Shropshire is a larger-framed sheep than the Southdown. It also has the desired characteristic of fattening early, but takes a little longer than the Southdown. Large numbers of Shropshire rams are used for mating with other lines of ewes. The cross produced when mated with either Corriedale of half-bred ewes is a good line. They come to hand early and make an excellent carcase. The cross produced when the Shropshire ram is mated with any of the long-woolled ewes takes longer to get ready for the market. The coarser the breed of ewe, the longer does the lamb take to fatten up on the same class of feed. The Shropshire's distinctive markings are black round the eyes, black on the lower part of the face and under the jaw, and mostly black on the lower part of the legs. The number of Shropshire rams is 912 in the North Island and 2,457 in the South Island, a Dominion total of 3,369.

At present there is only a small number of Suffolks in New Zealand. The breed is a prime mutton line; the lambs come to hand early, and, like the rest of the Down family, usually command the best ruling prices. The Suffolk markings are face and head completely black in colour, the head being clear of wool, giving the sheep a bald-headed appearance. The lower part of the legs are all black, and, as mentioned, this breed could more rightly be termed "blackface" than the Southdown.

The few Dorset Downs in the Dominion were imported last year, the number consisting of two rams and five ewes, and the progress of the breed here will be watched with interest.

Some farmers adopt the good practice of mating any ewes (either cull or aged) which they are going to keep for the lambing season only with Down rams, and, when ready, the ewes and lambs are either sold separately or as one line ("all counted"). Farmers who use their place only for raising fat lambs commonly buy up almost any line of ewes, mate them with Down rams, and, when either the ewes or lambs are ready, sell them. By working in this manner the farm can be given from two to three months' spell before the next new lot come on the place.

Other breeds and breeding for fat lambs will form the subject of future notes.

—*J. G. Cook, Live-stock Division.*

THE ORCHARD.

HARVESTING THE PIP-FRUIT CROP.

While small lines of early pip-fruits have been picked during the past month (Beauty of Bath apple was ready for the Christmas market in some localities), it is not until the month of February that the harvesting of the main crop of pip-fruit commences.

The modern practice of using more care and discrimination in picking the fruit has given most gratifying results, especially with the earlier-ripening varieties. This is a difficult art, however, owing to the widely differing habits of varieties and the different uses to which the fruit is to be put. But much of the loss in transit and storage, and of the disappointment to buyers and consumers, will be avoided if the pickers are carefully instructed and supervised.

For export purposes experience has shown that if pip-fruits are picked at the first sign of maturity, and afterwards receive proper treatment, their keeping-qualities are greatly enhanced. Practically all the Cox's Orange, Golden Pippin, Scarlet Pearmain, Worcester Pearmain, and Allington Pippin apples were away from Nelson about the middle of February last year. While awaiting shipment they were in the cool store, and on arrival in London opened up in good condition.

It is very tempting to simplify the work by making one picking of the crop, but it is not possible to do so successfully ; a large proportion will have reached maturity, while the balance is immature.

Pickers will earn the gratitude of the packing-shed staff and save a great deal of unnecessary work if all really waste fruit is not put into the boxes but is dropped at the foot of the trees. It is tiresome for graders to have to cull it out of the better qualities when it obviously is only suitable for pig-feed. At the end of the harvest a number of such young animals will find good grazing in many an orchard for a considerable period.

PACKING FOR EXPORT.

The export-fruit pack is generally very commendable ; a tendency to slackness is the commonest defect. A box so packed is very quickly filled, but it weighs light, and the fruit is subject to bruising. The fruit, when packed, must stand only a very little above the edge of the box, but it must be very firmly and solidly packed by means of careful grading and fitting. Such a pack takes longer to put up, but is then satisfactory in every way.

Consignees still charge us with marking a large proportion of our cases in such a manner that the marks are not legible—at any rate on arrival at destination. This is a very serious charge, as any one who has had to sort and handle a large quantity of fruit knows. One can only come to the conclusion that dressed ends on the cases are a necessity whether stencilling is done or a label is used. The latter method is given a very strong preference by London agents. There is considerable art in getting labels to dry on smoothly and tightly. The first requisite is a good paste, which is best mixed with cold water and then heated till cooked. Another is to allow the label to saturate before application, and finally brush out all air-bubbles.

GENERAL.

The trees will now be bearing down with the weight of the fruit, and cultivation will soon have to cease. To maintain fertility where heavy crops are borne, to supply humus to soils where this is lacking, or to smother bad weeds such as couch-grass or twitch, a cover-crop may be sown now with great advantage. Usually a moderate dressing of superphosphate or other manure is given at the same time.

Little other work can be done during the harvest, but when spare moments are available keep a good lookout for developments in the orchard, and clean up the trees with a good spraying as soon as the crop is off ; an excellent chance is then afforded of dealing with aphis and red mite.

This is the best time of the year for budding orchard-trees.

—*W. C. Hyde, Orchard Instructor, Nelson.*

CITRUS FRUITS.

Weather conditions have been exceptionally moist for this season of the year, and citrus groves have benefited thereby. However, this has caused an abnormal growth of weeds. As soon as a favourable opportunity presents itself these should be dealt with by thorough cultivation. The second delayed application of bordeaux, 4-4-40, may still be applied for control of fungoid diseases.

FIREBLIGHT.

Attention is drawn to the fact that fireblight, among other diseases scheduled in the Orchard and Garden Diseases Act, 1908, is notifiable to the Department of Agriculture. Notification of the appearance of the disease must be immediately made to the office of the District Orchard Instructor. Failure to comply may render any person liable, on conviction, to a penalty of £20. It is as well to remind growers of fruit-trees generally that the onus rests upon them, under the Act, to see that all reasonable steps are taken to have their trees kept free from the disease. Those occupiers of orchards who fail to effectively comply with the provisions of the Act in this respect are liable to the same penalty as above quoted.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

DISPOSAL OF SURPLUS STOCK.

At the present time, on the majority of plants, the housing and run accommodation will be taxed to the utmost. On top of this the young stock are rapidly developing, and are day by day making greater demands on the accommodation available. Hence the necessity of weeding out every bird that is not likely to show a profit over its keep. If the evils resulting from overcrowding are to be prevented, and if the most money is to be made from the plant, this is a matter that the poultryman cannot afford to ignore. Especially does this apply in the case of surplus cockerels. Be it ever remembered that the most profitable period to market a cockerel is at an age of four and a half to five months. Of course, this is not to say that because it has attained this age it is naturally in a prime table condition, or that the best price will be secured for it, for no profit can be made from a cockerel sold as a table bird if it has been neglected in any way or kept on a lean diet.

A cockerel should be fed and managed in such a way that it will rapidly lay on flesh and be in a prime condition at the age mentioned. In other words, as in the case of the fat lamb, it is the one brought rapidly on which is the most profitable. When a cockerel reaches an age of between four and a half and five months it commences to grow its adult feathers. Obviously, it cannot be expected to produce these and put on flesh at the same time. The production of a maximum weight of flesh in a minimum period of time is the ideal to aim for. A weakness on many plants in developing the market cockerel is in providing it with a mere living diet, or with a mash chiefly made up of green stuff, boiled potatoes, &c. As a means of reducing the cost of production these cheap foodstuffs may be sparingly included in the ration, but the best results cannot be obtained unless the great bulk of the ration consists of wholesome ground-grain material. The following mash is recommended after the priming process has commenced: Equal parts by measure of wheat-meal, maize-meal, and bran, the whole being mixed with milk or soup into a crumbly mass. Feed three times a day all that the birds will clean up. Green food should be fed separately during the day. Where milk is available this should be given in large quantities to drink. A good method of using skim-milk is to let it sour, pour off the whey, and boil the curd before feeding. Grit, of course, should be available to the birds at all times.

CULLING.

As to culling unprofitable hens, March is the best time of the year for doing this, but nevertheless some good weeding-out work can be done in February. True, it demands considerable judgment to safely cull at the latter time, but to the man who constantly works among his flock and thereby develops his powers of observation it should be a fairly easy matter to detect at a glance a bird that is failing in egg-production, a failing which is as often as not the result of a weak constitution.

Generally speaking, the bird that moults first should be the first to be culled. Then, in the case of yellow-skinned birds such as Leghorns, Rocks, Wyandottes, &c., it will usually be found that the legs of the good layer at this period of the year present a more or less bleached appearance. On the other hand, the legs of the poor layer will exhibit a bright-yellow colour. Nevertheless, there are exceptions to all rules. As an instance, a good layer which has been used during the season for the hatching and rearing of young stock, and which has not laid to her full producing-capacity, will in all probability retain the yellow pigment in the legs, as in the case of the bird not possessed of high producing-power. Thus, when the leg-colour is being taken as a guide to culling the unprofitable bird, local conditions must always be taken into account. In other words, it is a safe indication only where all members of the flock have been previously fed and handled in a similar manner. As is the case with early moulting, leg-colour is not always an indication of the conclusion of the individual fowl's normal laying-period. It is often caused through broodiness and allowing the bird to sit on the nest for weeks at a time.

Of course, a change of food or a change of quarters is apt to bring on an early moult at this period of the year. Some poultry-keepers, in accordance with advice given, are forcing their hens to moult now, and imagine that under this method the birds will come on to lay in the winter months. I know of many breeders who tried this scheme years ago, but who utterly failed in their objective. The birds moulted all right, but failed to lay when expected. In fact, they mostly moulted a second time before they resumed laying, by which time the cheap-egg season was approaching.

Poultry-keepers lacking in experience in culling and desirous of assistance are reminded that the services of the Department's Poultry Instructors are available for this purpose.

SIZE OF EGGS.

The only sound argument against high-type layers is that their eggs are often on the small side. There are exceptional cases where heavy producers lay eggs of a decent weight, but unfortunately the tendency is in the other direction. Indeed, far too many breeders are aiming for numbers, and are thereby failing to counteract the small-egg tendency which must in the near future have a very harmful effect on many strains of utility poultry. Many breeders are pinning their faith to an export trade as a means of relieving the summer surplus, but they will find that the critical oversea markets will not pay full rates for undersized eggs, and only the best values will warrant an export business. Especially is it necessary to remember quality in initiating a trade. The warning is here, and the remedy is simple. Just as heavy-laying quality may be maintained and advanced by judicious mating, so the size of the egg may be maintained or increased in reason by the same process. A hen, however good a layer, should not be put in a breeding-pen if it lays a very small egg. The birds laying the best eggs should be chosen, providing, of course, their laying-capacity is satisfactory and they exhibit the desired points indicative of strong constitution.

As a means of tracing birds which lay good-sized eggs I cannot urge too strongly the use of trap-nests during the period from now until the breeding-birds are selected some time in March. A man with a trained eye for form can readily distinguish between the good and bad layer, but it is impossible to judge from the appearance of a bird the size of egg likely to be produced. It must be admitted that individual hens will sometimes lay eggs of varied size according to the season of the year, &c., but as a rule a normal product may be looked for just before the termination of the laying season. One of the secrets in maintaining a large-egg-laying strain is in knowing that the male is a son of a mother which produces an egg of the desired size. Obviously, this cannot be ascertained unless the use of trap-nests or single pens is resorted to. Full particulars of a simple style of trap-nest were published in the last March number of the *Journal*.

GREEN FOOD.

I would again emphasize the importance of losing no time in making every provision possible for the growing of ample green stuff for winter use. No flock can possibly thrive in its absence. It not only tends towards maintaining the birds in a healthy condition, but it also reduces the cost of the food bill. Any plants of the cabbage family are suitable for the purpose, while finely chaffed succulent green oats or barley will be relished by the birds during the late autumn and winter months.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

EXTRACTING.

IF the bees have received adequate attention, and have been supplied with sufficient super accommodation, there should be some honey fit for extracting before the end of January. There will still be a flow of honey, however, and, consequently, more or less unripe honey in the hives; it will therefore be necessary to make a point of seeing that any combs taken from the hive for extracting purposes are sealed. While it may not be detrimental if an odd comb or two in an extracting is not fully sealed, the apiarist cannot afford to risk many combs with even a quarter of the honey unsealed. The safer course for the less-experienced beekeeper is to take off nothing but fully sealed combs.

Escape-boards are sometimes a convenience in taking off honey for extracting. Boards made for the greater part of wire cloth are preferable, as they permit of the warmth from the bees rising to the honey; such boards are obtainable from dealers in beekeepers' supplies. It will be necessary to see that there is no brood in the combs above the escape-board; the bees will not go down if any of the combs contain brood. If the boards are inserted late in the afternoon all the bees will have gone down to the brood-chamber before the following morning, and the honey can be taken off without disturbing them. When taking off honey keep a sharp lookout for signs of foul-brood.

The honey from diseased colonies should not be put through the extractor until all other extracting is finished. The combs from infected colonies should be destroyed after the honey has been extracted.

The Honey-house.—Most beekeepers who have only a few colonies of bees will make use of existing buildings for extracting. It will be necessary, however, to select a building that can be made bee-proof. If nothing better offers, a tent may be used for the purpose, provided it is made bee-proof. If necessary, floor-space sufficient to take the extractor, uncapping-can, and a few supers can be made to answer the purpose, but where it is practicable a floor-space of not less than 100 sq. ft. should be provided.

The Extractor.—A two-frame extractor will answer the purpose for anything up to fifty colonies. If the apiary contains nothing but full-size frames an extractor fitted with 10 in. reversible baskets should be selected, preferably one in which the baskets are removable by simply withdrawing a hinge-rod. While automatic reversing-gear is essential in the four-frame extractors, it is rather a detriment in the two-frame size; there is not sufficient room for both baskets to reverse at the same time as in the larger sizes, and in following each other they frequently jam. It is more satisfactory to reverse the baskets by hand. If half-depth frames are used, 12 in. baskets will be required.

The Uncapping-knife.—What is known as the Bingham knife is the one in general use. It is necessary to make some provision for keeping it warm, and this can be accomplished by immersing it in hot water. The simplest arrangement for providing this consists of a shallow tray about 3 in. deep, made by cutting a benzine-tin to that depth, heated by a single-burner Perfection lamp. It is an advantage to have two knives, so that one can be warming while the other is being used for uncapping the honey. A good steam-knife is preferable when there is sufficient extracting to warrant the outlay.

The Capping-melter.—A capping-melter is not essential, but it is a very useful adjunct. There are several melters on the market. Some are designed to deal not only with cappings but also with full-size combs of thick honey. If only the melting of cappings has to be provided for, one of the less-expensive makes is all that is required. The makers of the melter selected will advise as to the best means of heating. If the heat arising from the melter is found objectionable the combs of honey can be uncapped over an uncapping can or box, and the cappings allowed to drain for twenty-four hours before being melted. A hive-body, with strips ½ in. square nailed at ½ in. intervals across the bottom, placed in a tray with a lip provided at one end to drain off the honey, answers admirably as an uncapping-box. It is necessary also to nail a strip across the top to rest the frame of honey on while uncapping.

If the frames have a top bar $1\frac{1}{16}$ in. in width, cut right down to the top bar when uncapping; that is the natural thickness of a brood-comb. If the Hoffman frame or the simplicity frame with narrower top bar is used, proportionately less. After placing the combs in the baskets give the extractor a few sharp turns; then reverse the baskets and complete the extraction of the honey from the other side; again reverse the baskets, and complete the extraction of the honey from the side from which a portion was thrown by the first few revolutions.

Honey-tank, &c.—It will be necessary to provide a vessel of some description as a container for the honey after it has been extracted; the size will depend on the crop expected to be handled. A round galvanized-iron or tinned-steel tank 34 in. in width and 36 in. deep will hold half a ton of honey, and is a very convenient size for a small apiary. A strainer made of cheese-cloth or fine wire gauze will be required. The tank, which should be fitted with a 2 in. honey-gate, should be placed on a stand high enough from the floor to get a 60 lb. honey-tin comfortably under the tap. The extractor should be placed on a similar platform, and securely anchored with anchor-rods usually supplied with extractors. The honey should be allowed to remain in the tank for forty-eight hours, for the scum to rise, before it is run into the export tins or other containers.

TESTING THE HONEY FOR RIPENESS.

If all the combs taken from the hive have been fully sealed testing will be an unnecessary precaution. The bees are the best judges of the ripeness of the honey; they will not seal the combs until the honey is fully ripe. If, however, for any reason some unsealed honey has been extracted the honey should be tested with a Twaddle hydrometer. Full instruction in the use of the hydrometer is found in the Department's Bulletin No. 55, to which beekeepers are referred. This bulletin, which contains much information of value, is obtainable from the Department, price 6d.

—*H. W. Gilling, Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

THE most important seasonable work is to finish the planting of brussels sprouts, broccoli, cauliflower, savoys, cabbages, kales, and leeks. Experience has shown that unless planting is completed early in February at the latest, only partial development in these crops must be expected. Planting was dealt with in the *Journal* for last month.

Celery: In the warmer districts planting may be continued to the end of February. The self-blanching varieties answer best for such late planting, as they come in quickly; fine heads can be grown under the trench system. These varieties are not suitable for colder districts; they will not stand frost or even cold rains. Planting in such places should be completed early in January. Trenches are necessary to allow of moulding-up for blanching. Moulding or earthing up was in former times done a little at a time, as the plants increased in height, but comparatively few growers do so now, the plan not being at all suitable for New Zealand conditions. The lower leaves spread out to a nearly or quite horizontal position, and should be brought upright in the early stages of growth, otherwise they become rigid and cannot be brought up without injury. For this purpose a few inches of soil are returned to the trench—just sufficient to hold the lower leaves upright. This soil should not be applied in the ordinary way of moulding-up. The surface of the trench should be left level so that rain or applied water may reach all the roots. Moulding-up should be delayed till the plants are fully grown. Red spider and thrips at times attack celery, particularly in warm districts. These attacks can be prevented by maintaining sufficiently moist conditions of soil, and frequently spraying the plants with water. For leaf-spot and rust, spray every ten or twelve days with 2–2–40 bordeaux.

Tomatoes: Keep all side shoots nipped off; undue development of these is made at the expense of the fruit. Stop the tops beyond the fifth bunch of fruit. If the plants are growing very luxuriantly—a condition intimately connected with the class of fertilizer used and the amount of water in the soil—it will be wise to apply sulphate of potash. This may be given in water, using ½ oz. per

gallon, or as a top-dressing, giving a ¼ oz. per plant and watering it in. If blight threatens, spray with Burgundy mixture—4 lb. bluestone, 6 lb. washing-soda, and 40 gallons water.

Asparagus: Cutting should have ceased before now; next season's crop depends on the growth made during summer. A thorough watering occasionally will be of the greatest benefit if the soil be dry. This may be preceded by a dressing of nitrate of soda, 1 oz. per square yard, and followed with a liberal application of liquid manure.

Rhubarb: Cease pulling stalks, and, if possible, give a mulch of stable or farmyard manure. This will have a more beneficial effect on the next crop than anything else that can be given.

Onions: Keep the soil free of weeds and the surface soil loose. No fertilizers should be applied at this time; they would prejudicially affect the ripening of the bulbs.

Advancing crops of parsnips, carrots, and red beet intended for winter use should be thinned as early as possible. Where sufficient provision has not been made, a further area may be sown at once. These will have time to reach a useful though not a large size.

French and butter beans may still be sown. Sow lettuce thinly in drills and thin out to 8 in. or 9 in. apart.

Shallots and garlic should be ready for lifting, this condition being denoted by the withered tops. They may not be ready, however, if planted late.

Potatoes: Those who intend to save their own seed should select tubers weighing from 2 oz. to 3 oz. each, selecting well-shaped tubers from hills giving the largest proportion of table-size tubers. Leave them in the sun a few days till the skin is green, then place them in shallow boxes and store away in situations that are light and airy, but protected from rain.

—*W. H. Taylor, Horticulturist.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT FOR BLOWN COWS.

"SCEPTIC," Windsor, Oamaru:—

Could you inform me as to the risk likely to be incurred in the use of the trocar on a blown cow, or, in the case of a trocar being unavailable, the use of an ordinary pocket-knife? Please also state to what extent the following popular remedies can be relied on: Pouring cold water on the cow's back; giving a dose of about half a bottle of kerosene; giving a dose of milk and turpentine in the proportions of half a glass of turpentine to a bottle of milk; forcing a length of hose down the cow's throat.

The Live-stock Division:—

There is no danger in using a trocar, providing it is inserted in the proper position, which is at a point equally distant from the last rib, the bone of the loin, and the point of the haunch. In using a knife there is every likelihood of the gas escaping into the peritoneum and also under the skin, causing an emphysema, which is difficult to treat. As for the other remedies, cold water on the back would be of no benefit, but turpentine in milk is useful, or 2 tablespoonfuls of household ammonia in a pint of water. Inserting a piece of ½ in. hose-pipe through the mouth into the stomach will give relief by allowing the gas to escape, but the opening of the hose is liable to get blocked with food.

GETTING RID OF GIANT FESCUE.

"FESCUE," Kekerangu :—

Could you advise me as to the best method for getting rid of giant fescue? It is planted on a steep unploughable face, and has become so coarse that the cattle and sheep will not touch it. It was originally planted to prevent slips, but is now getting out of control, and is spreading over the flats as well.

The Agricultural Instruction Service :—

Your best plan would be to burn off the giant fescue and then stock heavily with cattle. The young shoots which come away after burning will be more palatable, and should be readily eaten by stock. The manure from the cattle should also help the other grasses to assert themselves.

PROPAGATION OF LOGANBERRIES.

"LOGANBERRY," Waitara :—

Will you please let me know if loganberries are likely to become such a pest as blackberries when grown in a farm garden or orchard, as the young plants seem to grow readily from fallen fruit, and the long shoots root at the ends similar to those of the blackberry ?

The Horticulture Division :—

It is not anticipated that the loganberry will become a pest in the manner referred to. The tips of the long shoots root when in contact with the ground, but the plant does not stool out in the manner of blackberries. The general experience is that fertile seeds are not freely produced as in the case of blackberries. Young plants obtained by layering the tips of the shoots in autumn are ready for planting out in spring. They make more thrifty plants than those raised from cuttings of the shoots.

WEATHER RECORDS.

DECEMBER, 1922.

THE following general summary and rainfall statistics are supplied to the *Journal* by the Director of the Dominion Meteorological Office (Mr. D. C. Bates) :—

New Zealand may be said to have a number of climates, for, owing to its great length and lofty mountain-ranges dividing the greater part of its eastern coast from the prevailing westerly winds, remarkable differences appear in its climatic records. The effects of different atmospheric disturbances also prove interesting studies, and the changes of December almost defy brief analysis or general summary.

There were three disturbances at least from ex-tropical regions, and three or four distinct westerly or antarctic disturbances. Though these at times brought wind, yet it was not a stormy month, and the plentiful rains experienced on the eastern coasts, where they were much needed, were not so welcome in other parts.

One observer in the Manawatu reports : "December was a calm, moist, muggy month, with a rainfall 20 per cent. below the average. There were ten foggy days. The weather has been very irritating from a farmer's point of view—just too wet to allow of anything being done, and that right in the middle of the busiest part of the year. The hay crops are spoiling for want of a chance to get them in, and the early oat crops are in much the same position. The shearing is still dragging on—the weather on several occasions just falling short of being fine long enough to allow the sheep to get dry, and when it happened to be fine the wind did not blow."

From the Nelson district : "The month commenced with a cold snap. The weather during the remainder was cloudy, showery, and sultry—not like the usual Nelson weather. There was a lot of thunder around, but very little just about this immediate neighbourhood (Upper Sherry River). Little or no wind was felt until the 27th, when, after some rain, it commenced to blow from the west, and it was the heaviest wind felt round here for some time, taking a heavy toll from the crop of plums, apples, &c."

From Hanmer: "The month has been marked by three unusual visitations—*i.e.*, a fall of snow, 3 in., on the 1st, a terrific thunderstorm on the 16th, and an earthquake of great severity on the 25th. The rainfall, 6·15 in., was also unusual for this time of year."

An observer in Southland says, "We have experienced a dull, sunless, and very unsummerlike month."

Electrical conditions were prevalent on the 15th and 16th, and the cyclone which passed in the North about Christmas Eve may be generally regarded as a lucky escape from weather conditions which might have upset the holidays, for its path was fortunately northward of the Dominion, although it accounted for considerable wind and rain in the northern and east-coast districts.

RAINFALL FOR DECEMBER, 1922.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.
		North Island.		
	Inches.		Inches.	Inches.
Kaitaia	4·26	11	2·0	3·28
Russell	3·67	12	0·98	2·05
Auckland	5·61	17	2·58	2·82
Hamilton	3·01	18	1·01	3·68
Kawhia	3·00	14	0·62	3·21
New Plymouth	3·95	15	1·18	4·28
Inglewood	6·86	19	1·56	7·72
Whangamomona	3·79	18	0·64	5·98
Tairua, Thames	5·52	11	1·96	4·30
Tauranga	2·50	12	1·18	3·39
Maraehako Station, Opotiki	4·24	13	1·00	2·82
Gisborne	6·65	11	2·04	2·13
Taupo	1·70	9	0·56	3·66
Napier	4·78	13	1·28	2·5[illegible]
Taihape	4·40	14	1·31	3·43
Masterton	3·35	15	0·85	2·57
Patea	4·38	15	0·93	3·35
Wanganui	3·11	9	0·79	2·63
Foxton	1·94	10	0·37	2·17
Wellington	0·74	9	0·18	3·24
		South Island.		
Westport	8·36	17	2·55	6·60
Greymouth	7·78	15	2·37	8·95
Hokitika	14·38	17	2·98	10·51
Arthur's Pass	15·47	12	3·75	12·02
Okuru, Westland	12·06	14	3·32	11·73
Collingwood	6·65	10	1·96	8·01
Nelson	1·29	8	0·42	2·70
Spring Creek, Blenheim	1·41	9	0·49	1·93
Tophouse	7·29	19	1·22	5·00
Hanmer Springs	6·15	11	1·70	2·89
Waiau	4·02	10	1·90	2·51
Gore Bay (North Canterbury)	4·22	9	2·48	2·12
Christchurch	2·21	8	0·95	2·03
Timaru	3·56	16	0·94	2·38
Lambrook Station, Fairlie	4·38	13	0·70	2·33
Benmore Station, Omarama	4·23	12	1·20	1·77
Oamaru	4·66	17	1·27	2·06
Queenstown	1·95	5	0·52	2·55
Clyde	2·81	15	0·68	1·79
Dunedin	3·98	18	1·18	3·49
Gore	4·32	18	0·88	3·36
Invercargill	3·76	18	0·90	4·36

EXPORT OF APPLES, 1923 SEASON.

CONDITIONS OF GOVERNMENT GUARANTEE.

CONDITIONS for the Government guarantee of legitimate marketing-expenses up to 11s. per case on shipments of apples have been formulated as follows :—

1. The guarantee to be limited to approved varieties and classes of fruit, packed in compliance with the requirements of the "Extra Fancy" or "Fancy" grades, and to be restricted to a maximum of 150,000 cases.

2. The Government's liability under the guarantee to extend to the same charges for packing, shipment, &c., as have applied in the past. In this connection local charges up to placing the fruit on to an approved coastal steamer or railway-truck not to exceed 3s. per case. All subsequent charges to be allowed, provided they are reasonable and necessary in connection with the placing of the fruit on the oversea market; further, that no allowance is made for cool storage unless an approved system of precooling is adopted, in which event such allowance shall not exceed 5d. per case; and, further, the insurance allowance shall not exceed that required to provide an ordinary marine-risk cover.

3. The guarantee to be limited to fruit grown and shipped on consignment by or on account of *bona fide* fruitgrowers or fruitgrowers' co-operative societies, through the New Zealand Fruitgrowers' Federation or other channel approved by the Minister of Agriculture.

4. The Government reserves to itself the right to limit the quantity of fruit shipped to any particular port should shipping accommodation, freight rates, or market conditions, &c., be deemed unsatisfactory.

5. All fruit to qualify for the guarantee must be passed by a Departmental Inspector, and must be packed in accordance with the export regulations, subject to the modifications hereinafter set out.

6. Payment of claims under the guarantee shall not exceed 11s. per case, and shall be calculated on the basis of the average price received by the claimant for the whole of the fruit exported on his account during the season, as against the average cost of placing such fruit on the market.

7. The Government reserves to itself the right—(*a*) to insist on all fruit being precooled prior to shipment, if deemed necessary; (*b*) to withhold the privileges of the guarantee from all fruit shipped in vessels the storage facilities of which are held by the Department to be unsatisfactory.

EXPORT REGULATIONS.

With respect to the export regulations, it has been decided to allow the following modifications as regards apples for the 1923 season :—

Classes.

The existing partial red and striped class will be separated, and a distinct striped class instituted. The colour requirements of the striped class will be 33⅓ per cent. and 20 per cent. respectively of good typical colour for "Extra Fancy" and "Fancy" grades.

Colour Standards.

Notwithstanding the provisions of the regulations, which will not be altered in this respect until further experience has been gained, apples carrying 10 per cent. less colour with respect to "Extra Fancy" and 5 per cent. less colour with respect to "Fancy" than is required by the regulations will be accepted during the 1923 season for export to Europe. The above reduction in colour will apply to all the classes, including the "striped" class above referred to.

Grades of Fruit.

In addition to the grades "Extra Fancy" and "Fancy," it has been agreed, on the recommendation of the Fruitgrowers' Export Committee, that apples conforming to the undermentioned "Good" grade will be approved for export for the 1923 season :—

"Good" grade: Apples of this grade shall be of not less size than 2½ in. (175 apples per case), sound, smooth, and clean. They shall be mature, well formed, hand-picked, true to name, and free from disease, visible bitter-pit, skin-puncture, or skin broken at stem, and other defects. Slightly blemished apples may be included in this grade, provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. Apples affected by spray injury may also be included in this grade, provided that no individual apple shall have more than 10 per cent. of its surface affected thereby. The individual apples of "solid red," "partial red," and "striped" varieties shall carry not less than 30 per cent., 15 per cent., and 10 per cent. respectively of good typical colour. The individual apples of "yellow or green" varieties shall be of good characteristic colour.

The Minimum and Maximum Sizes of Apples for Export.

The minimum and maximum sizes of apples of "Extra Fancy" and "Fancy" grades approved for export shall be those set out against each variety respectively in the list of varieties approved for export.

Specifications of Export Apple-case.

The inside measurements of the export bushel case shall be 10 in. by 11¼ in. by 19¾ in.

Sizes of timber: The ends shall be made of boards of the following size—10 in. by 11¼ in. by ¾ in.; one-piece board at each end; both end boards to be planed on the outer side. The sides shall be made of boards of the following size—10 in. by 21¼ in. by $\frac{5}{16}$ in.; one or two boards optional for each side. The tops and bottoms shall be made of boards of the following size—11 in. by 21¼ in. by $\frac{5}{16}$ in.; one or two boards optional: Provided that tops and bottoms may be made of boards of the following size—11 in. by 21¼ in. by $\frac{3}{16}$ in., to be used with the addition of four cleats per case of size 11 in. by 1 in. by $\frac{5}{16}$ in.

Nailing: Nails used to be not less than 1½ in. long, 14 gauge. Nails to be spaced not more than 3 in. apart, and the outer nails of each board to be not more than 1 in. from the edge of board.

Strapping: All cases to be strapped with a wire or steel band, such strapping to be tightly applied and to be not more than 1¾ in. from end of case.

Marking of Cases.

The centre of each end of the case is to be reserved for the application of the shipping-mark, which in each instance will be the broker's number, consisting of three figures. To enable some uniform system of marking to be adopted, as an aid to sorting out, the other essential particulars are to be placed in the same positions on each case respectively—namely, the grower's or packer's registered number in the lower left-hand corner, and the variety, grade, and size of the fruit in the lower right-hand corner, irrespective of whether stencils or labels are used. Where stencils are used, the accompanying facsimile of the stencil, reduced according to scale, is recommended for a registered export brand.

This example sets out the maximum and minimum wording required. "New Zealand" should be in not less than 1¼ in. lettering. The word "Apples" to be in not less than ½ in. lettering. The grower's or packer's registered export number to be in the same-sized type as "New Zealand." "150" represents the number of apples in the case. This, together with the designations "Jonathan" and "Fancy," will require to be branded by means of rubber stamps, the lettering of which should be ½ in. The shipping-mark "345," representing the broker's number, must be in large figures of not less than 3 in. Both ends of the case are to be branded alike. Paper labels, apart from any form of ornamental design, must also bear the wording represented by the stencil copy.

Should any grower or packer wish to use any other mark, such as the name of his orchard or packing-shed, such marks will have to be applied to either the lids or sides of the case, as it is essential that no other marks than those indicated be applied on either end.

Owing to the large number of exporters having on hand a supply of labels as used by them last season, approval may be given to use these for this season only, but all such labels will have to be overprinted or branded with the broker's number to whom they are shipping, in large figures of not less than 3 in. aforesaid.

Numerous complaints have been received regarding the careless manner in which the branding of a large number of cases was done last season, especially where rubber stamps and stencils were used, in many instances the words and figures being quite unintelligible. More care must be observed in future in this direction, or the Inspectors will be forced to exercise their powers in rejecting for export all cases not intelligibly branded.

Registered Export Number.

The "registered number" issued to all growers under the Local Market Regulations will be declared to be the grower's registered export number also. The registered number of each grower must be branded on each case of fruit exported by him.

In respect to fruit packed by a packing organization to which a registered number has been allotted, such consignments may be marked with the registered number of the packing association only, provided that each grower's fruit is shown separately on the advice-note for examination, and stacked in separate lots so that the Inspector may have no difficulty in determining which is the particular lot under examination. For example, a line of 100 cases of Cox's Orange coming from two different growers would be submitted as follows :—

Shipping-mark.	Registered Export Brand.	Number of Cases.	Kind of Fruit.	Variety.	Grade.	Size.
345	P607 ..	14	Apples ..	Cox's Orange ..	Fancy ..	163
		14	,, ..	,, ..	,, ..	175
		8	,, ..	,, ..	,, ..	188
		12	,, ..	,, ..	,, ..	210
		12	,, ..	,, ..	,, ..	225
	Total ..	60				
345	P607 ..	8	Apples ..	Cox's Orange ..	Fancy ..	163
		5	,, ..	,, ..	,, ..	175
		7	,, ..	,, ..	,, ..	188
		9	,, ..	,, ..	,, ..	210
		11	,, ..	,, ..	,, ..	225
	Total ..	40				

These would be stacked separately in two lots and examined as different lines.

Should unavoidable circumstances prevent the adoption of this procedure, resulting in a line comprising a larger number of cases being submitted as one line, it must be definitely understood that the examination of same would be solely at the grower's risk, and in the event of any fruit forming a portion of the line being found to be unsatisfactory the whole line would be liable to rejection.

Packing.

Wrapping-paper : Apples of the various sizes as set out below shall be wrapped in paper of the size indicated opposite each respectively :—

Sizes 64's to 80's (both inclusive), paper 11 in. by 11 in.
Sizes 88's to 110's (both inclusive), paper 10 in. by 10 in.
Sizes 120's to 200's (both inclusive), paper 9 in. by 9 in.
Sizes 210's to 240's (both inclusive), paper 8 in. by 8 in.

In the event of the size of paper used being smaller than that specified above for any respective size of apples, such apples shall be double-wrapped by overlapping two papers.

APPLES APPROVED FOR EXPORT TO EUROPE.

Maximum Size.	Variety.	Minimum Size.	Maximum Size.	Variety.	Minimum Size.
		Solid Red Varieties.			
96	Baldwin	225	96	Tasma	225
96	Hoover	225			
		Partial Red Varieties.			
110	Crofton	225	96	Sharp's Late Red ..	225
96	Delicious	225	110	Shorland Queen ..	225
110	Dougherty ..	240	110	Shepherd's Perfection	225
110	John Sharp ..	225	96	Spitzenberg ..	225
110	Jonathan	240	110	Stark	225
110	King David ..	225	110	Wagner	225
96	Rome Beauty ..	225	110	Worcester Pearmain ..	225
110	Scarlet Nonpareil ..	240	110	Yates	240
110	Scarlet Pearmain ..	225			
		Striped Varieties.			
110	Adams Pearmain ..	225	120	Ribston Pippin ..	225
110	Allington Pippin ..	225	110	Senator	225
120	Cox's Orange ..	240	110	Statesman	225
96	Premier	225	110	Stayman	225
		Yellow or Green Varieties.			
96	Alfriston	225	110	Gravenstein ..	225
96	Ballarat	225	96	London Pippin ..	225
96	Boston Russet ..	225	96	McMahon's White ..	225
110	Brownlee's Russet ..	225	110	Newtown Pippin ..	225
110	Cleopatra	225	96	Parlin's Beauty ..	225
110	Claygate Pearmain ..	225	96	Reinette du Canada ..	225
96	Dunn's	225	110	Sturmer	225
110	Golden Pippin ..	225	96	Washington ..	225
110	Golden Russet ..	225	110	Willie Sharp ..	225
110	Grannie Smith ..	225			

APPLES APPROVED FOR EXPORT TO SOUTH AMERICA.

Maximum Size.	Variety.	Minimum Size.	Maximum Size.	Variety.	Minimum Size.
		Solid Red Varieties.			
80	Baldwin	140	80	Tasma	140
80	Hoover	140			
		Partial Red Varieties.			
96	Crofton	140	80	Scarlet Nonpareil ..	140
80	Delicious	140	96	Shorland Queen ..	140
96	Dougherty ..	140	80	Shepherd's Perfection	140
96	John Sharp ..	140	80	Spitzenberg ..	140
96	King David ..	140	96	Stark	140
80	Rome Beauty ..	140	80	Wagner	140
80	Salome	140	96	Yates	140
96	Jonathan	140			
		Striped Varieties.			
96	Adams Pearmain ..	140	96	Statesman	140
80	Premier ..	140	80	Stayman	140
80	Senator	140			

APPLES APPROVED FOR EXPORT TO SOUTH AMERICA—*continued.*

Maximum Size.	Variety.	Minimum Size.	Maximum Size.	Variety.	Minimum Size.
	Yellow or Green Varieties.				
96	Cleopatra	140	80	Newtown Pippin ..	140
80	Dunn's	140	80	Parlin's Beauty ..	140
80	London Pippin ..	140	96	Sturmer	140
80	McMahon's White ..	140			

SPECIAL CONDITIONS APPLYING TO EXPORT TO SOUTH AMERICA.

The modifications regarding colour standards allowed for European markets will not apply to apples for the South American markets.

Grades: No fruit below the standard of "Fancy" grade as defined in the Export Regulations to be exported to South America.

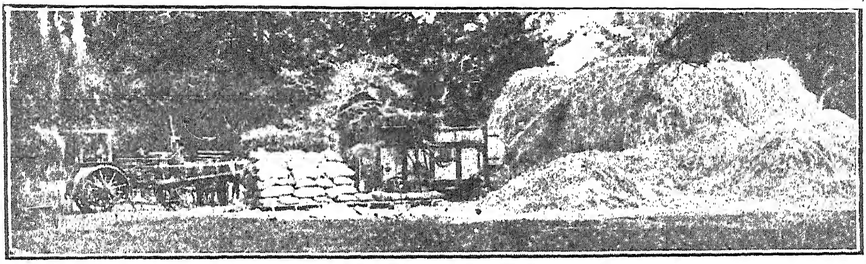
Cases: Specifications of standard export case to be strictly observed.

Packing: Corrugated strawboard to be used on top and bottom of cases. Wood-wool not to be used. The use of printed wrapping-paper is strongly recommended. All large fruit to be double-wrapped unless paper of sufficient size is used.

FORTHCOMING AGRICULTURAL SHOWS.

Woodville A. and P. Association: Woodville, 23rd and 24th January.
Helensville A. and P. Association: Helensville, 29th January.
Pahiatua A. and P. Association: Pahiatua, 9th February.
Te Puke A. and P. Association: Te Puke, 9th February.
Buller A. and P. Association: Westport, 9th and 10th February.
Northern Wairoa A. and P. Association: Mititai, 9th and 10th February.
Clevedon A. and P. Association: Clevedon, 10th February.
Rodney Agricultural Society: Warkworth, 10th February.
Dannevirke A. and P. Association: Dannevirke, 14th and 15th February.
Waimarino A., P., H., and I. Association: Raetihi, 15th February.
Wellsford A. and P. Society: Wellsford, 16th February.
Masterton A. and P. Association: Masterton, 20th and 21st February.
Te Awamutu A. and P. Association: Te Awamutu, 21st February.
Omaha and Pakiri A. and H. Association: Leigh, 21st February.
Rangitikei A. and P. Association: Taihape, 22nd February.
Opotiki A. and P. Association: Opotiki, 23rd February.
Franklin A. and P. Society: Pukekohe, 23rd and 24th February.
Rotorua A. and P. Association: Rotorua, 28th February.
Katikati A. and P. Society: Katikati, 1st March.
North Kaipara Agricultural Association: Paparoa, 1st March.
Taranaki Metropolitan Agricultural Society: New Plymouth, 7th and 8th March.
Waikato Central Agricultural Association: Cambridge, 7th and 8th March.
Morrinsville A., P., and H. Society: Morrinsville, 14th March.
Methven A. and P. Association: Methven, 15th March.
Hawke's Bay A. and P. Society: 20th and 21st March (Autumn Show).
Temuka and Geraldine A. and P. Association: Temuka, 22nd March.
Matamata A. and P. Association: Matamata, 22nd March.
Mayfield A. and P. Association: Mayfield, 24th March.

Importation and Quarantine of Dogs.—The prohibition of the importation of dogs into New Zealand from Great Britain, imposed in 1919 owing to severe outbreaks of rabies there, has been revoked as from 8th January. An amendment to the regulations under the Stock Act was gazetted on 8th January, making the period of quarantine on dogs from the United Kingdom a clear six months. Previously the period of six months included the time from embarkation of the animal in Britain.



The New Zealand

Journal of Agriculture.

Vol. XXVI.—No. 2.

WELLINGTON, 20th FEBRUARY, 1923.

MODERN SEED-TESTING.

THE NEW ZEALAND OFFICIAL SEED-STATION.

NELSON R. FOY, Biological Laboratory, Wellington.

THE idea of testing seeds before they are sown is not by any means a recent one, for in writings of the eighteenth century there is reference to the examination of seed. In 1869 the first seed-control station was initiated by Dr. Nobbe, in Saxony, and gradually seed-stations were instituted all over Europe. Among the most notable are those at Zurich (Switzerland) and at Copenhagen. These two stations may be termed the leaders of the world's seed-testing, and much valuable research work has been done there. In the British Isles Ireland has had a seed-testing station for twenty years, Scotland for about ten, and England for five years past. The United States of America and Canada have been testing seeds for many years; in the former country there is at least one station in every State, with the main station at Washington, while in Canada there are several large stations. Australia is also well provided in this respect. All these countries have some form of seed legislation, under which it is compulsory to have all seed tested, and necessary that it shall be of a certain standard of purity and germination before it is placed on the market.

THE NEW ZEALAND STATION.

In New Zealand a voluntary official seed-testing system, operated in connection with the Biological Laboratory of the Department of Agriculture, was initiated in 1909. A compulsory measure has been obviated largely through recognition by the local seed trade of the necessity of knowing the value of the seeds it handles, and to the desire of the merchants to keep the trade in New Zealand at a high standard. During the earlier period of the system only those samples of which the genuineness was suspected were forwarded for test, but at the present time practically the whole of the sales and purchases in the New Zealand trade are based upon reports issued from this Laboratory. In a sense, therefore, it may be said that the testing has become more or less compulsory, for the reason either that prior to making a sale a merchant must perforce procure a Government test before the intending purchaser will do business, or that the purchaser has the test made before he buys. Many local merchants carry out a large part of their own testing, but these tests are not usually recognized in the trade, being mainly for the firm's own information. Government certificates are necessary also in all export business, as nothing but an unbiased Government report is acceptable to overseas buyers. Most firms, too, when stock-taking have the whole of their stocks tested, in order that they may write off the worthless stuff and restock. It will be seen, therefore, that the activities of the seed-stations cover a wide field and do much towards maintaining a high standard in the trade. In addition to making germination and purity tests, researches in matters relating to seed-storage, loss of vitality in seeds, improved methods of testing, &c., are also carried out.

The inauguration of seed-testing by the Department was effected after a good deal of experimental work had been carried out. Seeds were at first tested free, but in 1916 fees of 1s. for germination and 2s. for germination and purity were fixed for merchants' samples. In 1921, owing to increased costs in operation and the necessity to make the service self-supporting, the fees were further increased to 2s. and 4s. respectively. Testing is still carried out free of charge for farmers, but few avail themselves of the service.

The following table shows the growth of the work of the seed-station from 1910 onward :—

Year ended March.	Number of Samples tested.	Year ended March.	Number of Samples tested.
1910	180	1917	2,700
1911	400	1918	3,859
1912	400	1919	6,261
1913	650	1920	8,165
1914	1,863	1921	8,800
1915	2,646	1922	9,400
1916	3,200		

For the ten months ended January, 1923, 7,500 samples have been tested, making an aggregate of nearly 61,500 samples dealt with since the establishment of the system.

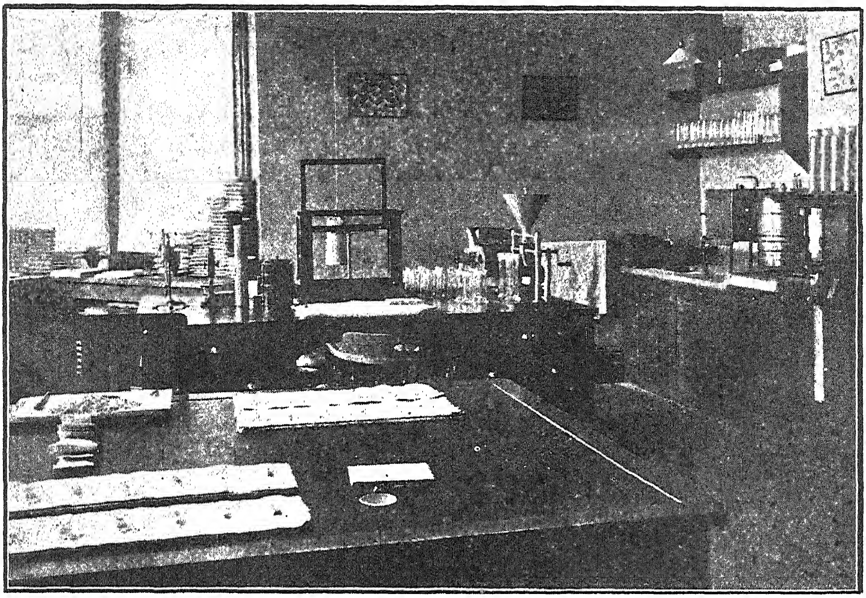


FIG. I. INTERIOR VIEW AT THE AGRICULTURE DEPARTMENT'S SEED-TESTING STATION, WELLINGTON.

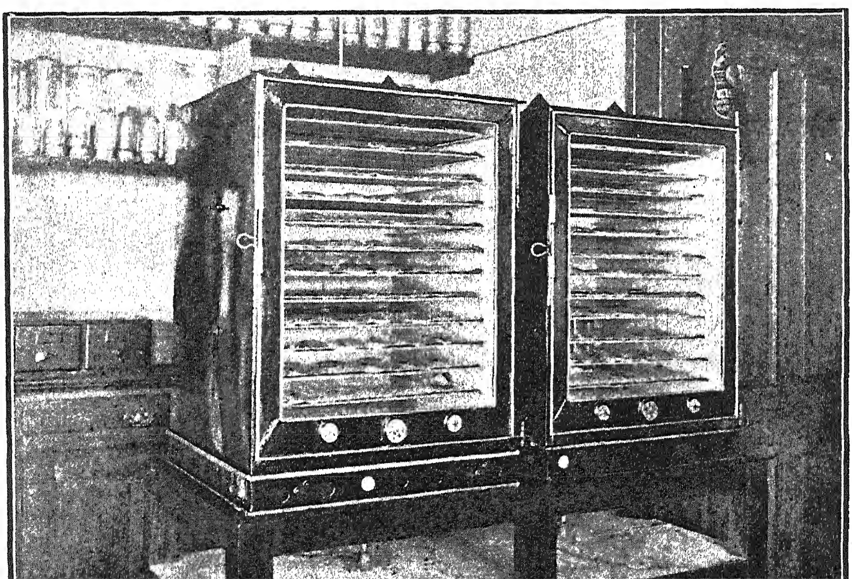


FIG. 2. LATEST TYPE OF WATER-BATH GERMINATOR.

This photo and the subsequent illustrations also refer to the Department's station.

[*Photos by N. R. Foy.*

METHODS OF SEED-TESTING.

The two methods of seed-testing—the Continental and the Irish—have been described previously in the *Journal*; in the former method only mature seeds are germinated, and in the latter both mature and immature seeds. There has been much discussion over the relative advantages of the two methods, the trend of opinion being towards the Continental. In New Zealand all testing is carried out on the Irish method, but the time may not be far off when, with one or two other countries, we shall have to fall into line and adopt the Continental system, in order that tests from all parts of the world may be uniform. Theoretically the Continental method is the more correct, its great disadvantage being the laborious and complicated methods of executing the tests, requiring more than double the operating force. The only case in which the Irish method is at present departed from at the New Zealand station is that of Waipu brown-top, which, as the lines usually contain a large percentage of empty glumes, is dressed until only full mature seed remains. The report on such a sample is given, for example, thus: Empty glumes, 40 per cent.; kernel, 50 per cent.; extraneous seeds, 10 per cent.; germination, 85 per cent.

THE NEW ZEALAND SYSTEM IN DETAIL.

As each sample is received it is given a number, and all the particulars concerning it are entered upon a special record card, one for each sample. Upon the card also is entered the dates on which the test is to be counted, and a space for the record of the purity analysis.

Process of Germination.

Germination tests are carried out in specially constructed germinators, of which there are three types—the all-metal water-bath germinator, which is enclosed at the sides, top, and bottom by a water-jacket; the glass, wooden-framed type; and the small water-bath type. All the more difficult testing, such as rye-grass, cocksfoot, dogstail, and fescue, is carried out in the first type, owing to its uniformity of temperature, correct degree of humidity, and the ease with which temperatures can be controlled. With the exception of the germinator for cereals, all the germinators are gas-heated. All the clovers, crucifers (swedes, turnips, &c.), cereals, peas, and vegetable seeds generally are germinated in the second type. It is proposed to gradually replace these with the first type. The small germinators are used for paspalum, Poa species, and any other seeds with which a high temperature is required.

The sample is well mixed and poured on to a sheet of stiff paper. From different portions of it are counted two lots of 100 seeds, which are placed on separate trays, these trays being placed in separate germinators. Thus all tests are made in duplicate, while four tests are made of Chewings fescue, cocksfoot, and Poas. The germinating-medium itself is simply coarse felt saturated with water and covered with two thicknesses of blotting-paper, the whole being placed on an asbestos tray. Each sample is covered by a 3 in. watch-glass raised at one side to allow of ventilation.

With the exception of paspalum, Poa species, cereals, and peas all seeds are germinated at a temperature alternating from 85° to 65° F.—85° for eight hours, and then allowed to fall to 65° for the remaining

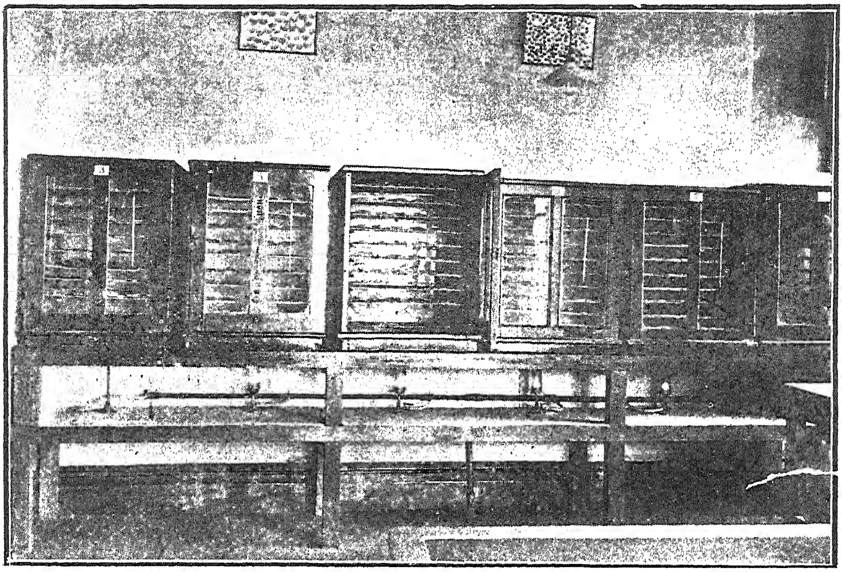


FIG. 3. WOODEN-FRAMED GLASS GERMINATORS.

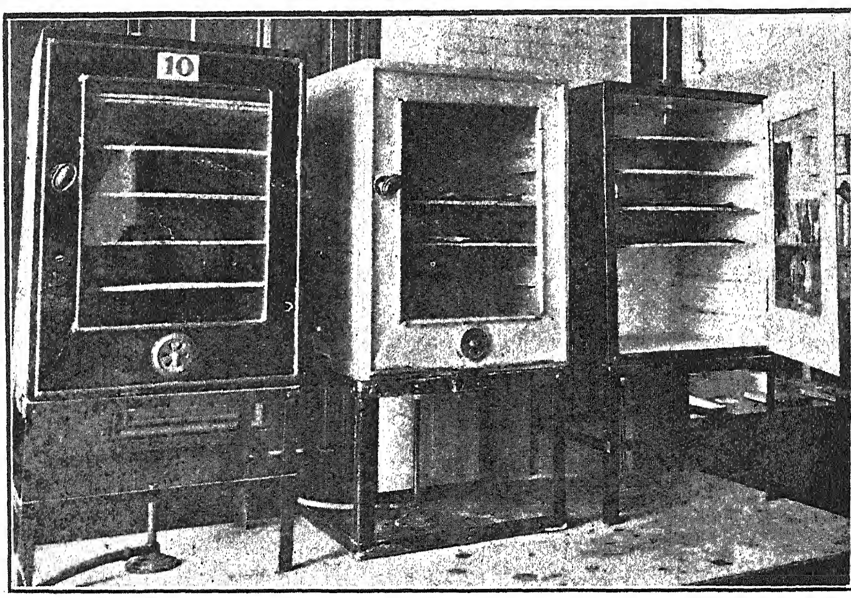


FIG. 4. SMALL WATER-BATH GERMINATORS FOR SPECIAL HIGH-TEMPERATURE TESTS.

[*Photos by N. R. Foy.*

sixteen hours. Paspalum and the Poas are germinated at 95° to 65°, peas at 75° to 60°, and cereals at ordinary room-temperatures. Peas and beans are soaked in water for sixteen hours before being placed to germinate, the latter being then germinated in damp sawdust.

Four counts are made of each sample, but the interval between the counts varies according to the class of seed under test, thus:—

	First Count.	Second Count (Interim Report).	Third Count.	Fourth Count (Final Report).
	Days.	Days.	Days.	Days.
Crucifers, clovers ..	2	4	7	10
Rye-grass, Lotus spp. ..	3	6	10	14
Fescues, dogstail, mangolds	4	8	13	18
Cocksfoot, paspalum ..	5	10	16	22
Poa spp.	6	12	20	28
Pinus spp.	21	42	63	up to 84

The seeds that have germinated are counted off and discarded, and the number entered upon the record card.

Purity Analysis.

In the purity analysis the percentage of extraneous seeds is given by weight. The sample is thoroughly mixed, and a definite amount weighed by means of a special balance. The amount weighed for examination varies for different seeds, being as follows: For the larger seeds, such as rye-grass, cow-grass, &c., 2½ grams; for the smaller seeds, such as crested dogstail, white clover, &c., 1 gram; for seeds of the Brassicas, such as rape, 5 grams; for oats, prairie-grass, &c., 10 grams.

The weighed amount is spread evenly over a squared surface and gone through carefully with an eyeglass. All extraneous seeds are picked out and weighed, and the percentage calculated. The remainder of the sample is then gone through, and any additional extraneous seeds picked out and their names entered, together with those found in the weighed amount, on the record card.

In the event of Californian thistle, clover dodder, or ox-eye daisy being found in a sample the number of seeds per pound is calculated and entered on the card.

Reports.

In every case after the second germination count a report is furnished to the sender. This gives the average germination after a specified number of days, and the percentage of impurities. The interim report is of special value for two reasons: Firstly, it gives the merchant (or other sender) some idea of how the line is shaping, and enables him to judge whether it is suitable for his purpose without his having to wait the full time for the final test. For instance, a sample of crested dogstail germinating 85 per cent. in the interim report will finish up with an approximate final of 95 per cent. Again, if a sample of rye-grass shows an interim result of, say, only 25 per cent. the merchant will know immediately that it is worthless. Secondly, the interim report gives a good indication of the vitality of a line. The degree of rapidity with which germination takes place is indicative of the vitality of the seed—a slow germination means low vitality, a rapid one high

FIG. 5. MAKING GERMINATION TESTS.

The nearest operator is counting seeds on to the tray, the other counting off germinated seeds.

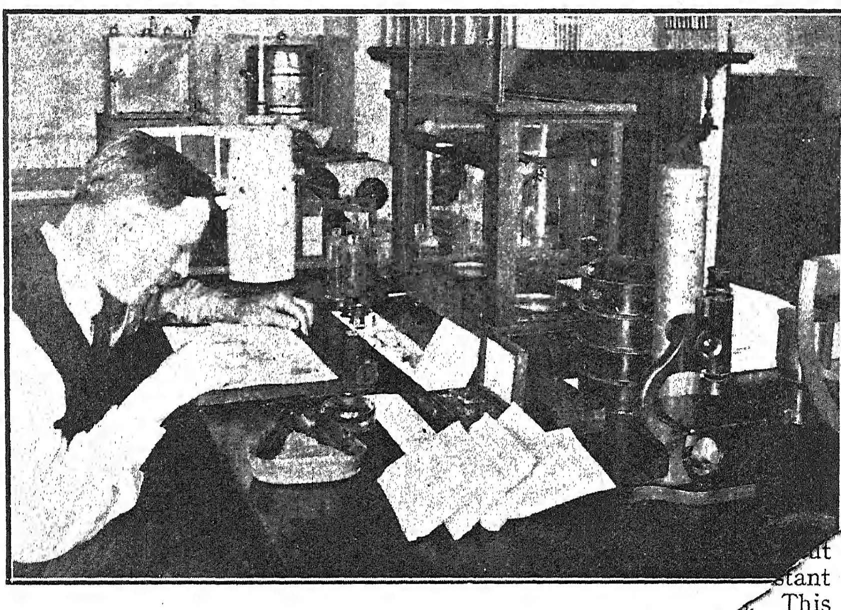


FIG. 6. MAKING A PURITY ANALYSIS.

ut
tant
This
s must be
[Ph

vitality. Thus the final reports on two separate lines of rape may both be 92 per cent., with interim reports at 90 per cent. and 80 per cent. respectively. At the expiration of the testing-period final reports are sent out. These show the interim and final germination, each at a certain number of days, and in the case of purity tests the percentage of extraneous seeds and a complete list of the impurities.

Any peculiarity noted about the sample, such as the presence of mites, &c., is also reported. In the case of clover-seeds there usually remains after the test is completed a certain number of seeds that have neither germinated nor rotted. These are seeds the seed-coats of which are too hard to allow the water to enter, with a result that germination does not take place. These are termed "hard seeds," and as they are living seeds, with the possibility of softening and germinating in the soil, half of the number is counted as viable and included in the final result.

SOME DIGESTIVE DISORDERS OF CATTLE.*

VARIOUS LOCAL EXPERIENCES.

W. C. BARRY, M.R.C.V.S., Veterinarian, Auckland.

THE study of the complex mechanism of the bovine digestive apparatus received attention from the early workers in veterinary science, but, although various theories were put forth regarding the act of rumination, it was not until later years that the process was clearly understood. Much work yet remains to be done, and it must be admitted that to-day our knowledge is not yet complete on this interesting physiological function.

Before passing on to abnormal conditions, the various changes to which the food is normally subjected before it reaches the fourth or true digestive compartment of the ruminant may be briefly summarized.

The terminal part of the œsophagus (gullet) is prolonged into a structure known as the œsophageal groove, which runs over the inner wall of the reticulum (second stomach) and enters the omasum (third stomach) towards its lower aspect, terminating there. This œsophageal groove is not a complete canal, but has two strong lips, or pillars, controlling its movements. An opening at its end leads into the omasum. It communicates with the reticulum, and also with the rumen (first stomach), and by means of this groove remasticated food can be passed directly from the mouth to the third stomach, a contraction bringing the opening to that compartment in apposition to the end of the œsophagus.

The rumen is of enormous size, and in an average-sized beast will hold 20 to 30 gallons. Running through its walls are found strong muscular bands, the so-called pillars of the rumen. These enable it to bring about its contraction and churning movements, and have an important bearing on torpid conditions of this compartment.

* Substance of a paper read at the Meeting of the Australasian Association [for the] Advancement of Science, Wellington (N.Z.), January, 1923.

It is important to remember that in the pregnant cow the heavy uterus is in contact with the rumen towards the end of pregnancy.

The reticulum is small, its capacity being about 3 pints. It is situated below and in front of the rumen, resting almost in contact with the sternum. Its mucous membrane is arranged in the form of cells resembling a honeycomb. Its contents are always of fluid consistency. Foreign bodies which have been swallowed are often found here.

The omasum, better known as the "book," is roughly circular in shape, and has a remarkable interior arrangement. Running across its interior is found a series of leaves, from large size to very small, and numbering about a hundred. These leaves are covered with mucous membrane carrying papillæ. Its function is the triturating of the coarser part of the food before its entrance to the abomasum (fourth stomach). Normally its contents are always dry, as its contraction squeezes the fluid portion on to the true stomach. The omasum is remarkable in that its nerve-supply is different from that of the other three stomachs. Stimulation of the vagus (centre controlling nerves to the part), while producing contraction of the other three, produces no effect on the omasum. Incidentally, it may be mentioned that the omasum is blamed, on post-mortem, for a number of deaths for which it was not responsible.

The abomasum is the true digestive stomach, secreting gastric juice.

A few remarks on the passage of the food through these complicated stomachs will now be made. First of all, it must be remembered that all solid ingesta swallowed returns again up the œsophagus in the process of rumination or "chewing the cud." On its first journey down it enters the rumen coated by the liberal quantity of saliva secreted (it is estimated that the salivary secretion for twenty-four hours may be as much as 112 lb.). Here it is rotated and crushed by a churning movement. In time the food is brought back to the œsophageal opening, and by a reversed form of movement arrives again in the mouth to undergo a thorough chewing. Then, if masticated sufficiently, it is passed to the omasum, where the still coarse fibres are subjected to further milling. Rumination in a healthy animal occupies at least seven out of the twenty-four hours.

As regards the distribution of fluids swallowed, it would appear that the reticulum first fills, and then the fluid is poured into the rumen, where a large amount of liquid is required to keep the mass soft. I was first interested in this through being privileged to see some simple experiments in drenching beasts with coloured fluids previous to slaughter, and making *post-mortem* observations. It was noted that where the animal was killed immediately after the drench most of the coloured fluid was found in the reticulum, but if killed from twenty to thirty minutes later the coloration was evident throughout the first three stomachs. The practical application of this would indicate the necessity of giving medicine in a large quantity of fluid medium.

The rumen always contains a large amount of ingesta, without the presence of which rumination would cease. It acts as a constant stimulus to the organ to perform its contractile movements. This explains why a large percentage of the feed of ruminants must be of a bulky nature.

Some commonly-met-with disorders connected with the digestive system will now be considered.

CESSATION OF RUMINATION OR "LOSS OF CUD."

This trouble is merely a symptom, and may be due to any one of a number of digestive disturbances as well as other conditions. It is, nevertheless, a very important symptom, and should always receive careful observation before making a diagnosis in obscure cases.

"DROPPING THE CUD."

In this condition the bolus of food drops from the mouth before being properly masticated. It is usually due to some mouth affection or tongue injury, and is often seen in cases of actinomycosis. An examination of the mouth usually reveals the cause. One such case seen recently was found to be caused by a piece of bone becoming fixed between the molar teeth and wounding the tongue. When the cud is dropped during rumination the fact points to some form of indigestion, and the animal should receive a laxative, followed by twice-daily doses of 2 oz. of bicarbonate of soda mixed in thin gruel. Change of pasture is beneficial.

PICA.

This name has been given to the condition often seen in the cow, in which she chews various indigestible objects, such as pieces of wood, rags, leather, &c. It is a condition of depraved appetite, and is probably only a symptom of disturbance in certain metabolic (changing) processes. It is very often transient, passing off in a few days, but in cases where it persists the cow rapidly loses condition. Treatment consists of a change of feed, securing a properly balanced ration, also giving the cow a mash of bran containing salt daily for a few days, or placing rock-salt for her to lick.

In the foregoing mention of pica I am not referring to the condition which exists in various parts of the North Island of New Zealand, and to which the name of Waihi disease has been given. In this complaint cattle, together with other symptoms, show a partiality for chewing bones and wood. Both the etiology and cure of Waihi disease have been fully worked out, and it is known to be due to soil-deficiency.

TYMPANITES OF THE RUMEN.

This condition is also variously known as "hoven," "blown," "bloating," "dew-sickness," "tympanitic indigestion," &c., and is probably the most commonly observed gastric derangement of cattle. It occurs usually as an acute condition, but is occasionally seen in a chronic or recurring form. Diagnosis is easy. The left flank is enormously distended, due to gas-formation in the rumen, and is drum-like to the touch. The trouble is sudden in its development, and in acute cases may cause death in half an hour or less from asphyxia, due to interference with respiration.

The cause of tympanites, apart from mechanical obstruction of the œsophagus in choking, is due to the nature of the feed. Clover more often gives rise to it than does any other green feed. We are all familiar with the cases which occur when cattle are turned into a paddock of clover for the first time. This becomes especially

dangerous after rain, or if the stock are allowed on in the morning before the dew is off the grass. Further, the more empty their condition the greater is the danger of cattle gorging themselves. In such case rapid fermentation follows, which quickly gives rise to the gas-formation and " blown " condition. Any succulent green feed is liable to produce tympany; also roots or potatoes, particularly if in an unsound condition. We observed some cases recently where the ingestion of watercress appeared to be the only traceable cause. Also in poisoning by the celery-leaf buttercup (*Ranunculus sceleratus*), seen a few years ago in Canterbury, we noted tympany occurring as a well-marked symptom in many of the cases.

An interesting case was related to me by Mr. J. Lyons, M.R.C.V.S., which happened in his experience in England. He was asked to see a cow which had broken loose during the night and gorged herself on frozen turnips, and next morning was found in a badly tympanitic condition. He relieved the tympany with the trocar and canula. This occurred in the month of February, and the cow, after the attack, never recovered her normal health ; rumination had ceased, and she apparently suffered from paralysis of the stomach-wall. She died during the month of July following, when Mr. Lyons made a post-mortem and found turnips still in the rumen, and, as it was not possible that they were consumed in the meantime, he was quite satisfied that they were the same turnips which five months previously had started the trouble.

Treatment depends on the gravity of the case. If there is much distress and danger of suffocation imminent it is advisable to puncture the rumen with the trocar at once. In less acute cases medicinal treatment is generally successful. Of remedies used I prefer oil of turpentine in doses of 2 oz., preferably given in a quart of raw linseed-oil.

Prevention lies in bringing stock on to green feed gradually, allowing them to graze at first only for a short period ; also, if dry feed be given previously the danger is greatly lessened.

Abortion is caused occasionally in pregnant animals by tympany of the rumen. Chronic or recurring tympany is sometimes a symptom of tuberculosis, brought about by an enormous tubercular enlargement of the mediastinal glands. Many cases of tympanites are followed by paralysis of the stomach-wall, giving rise to impaction.

IMPACTION OF THE RUMEN.

This gives rise to varying symptoms, and undoubtedly is the cause of a number of deaths, besides producing marked unthriftiness in condition in stock, more particularly in certain districts and at certain periods of the year.

In its typical form it is the result of what may be termed a dietetic indiscretion. A large quantity of feed of a dry nature is consumed, feed which has not much tendency to ferment, and consequently very little or no tympany is present. For instance, the cattle may have gorged on chaff, or gained access to a straw-yard and packed themselves. Indeed, the exciting causes are very similar to those which give rise to impaction of the colon in the horse.

However, it is not this acute type that will be dealt with here, for the reason that in this country it is not often met with, but, rather, a form which arises slowly and often takes weeks or longer to manifest

itself, and, unfortunately, in some districts affected by long spells of dry weather and scarcity of water, is all too common. This form is seen in the late summer and autumn, is the result of grazing on dry, innutritious grasses, and, as already indicated, is influenced by an extra dry summer. The symptoms come on slowly, nothing being usually noticed until the animals have lost considerable condition, when the owner realizes something must be wrong. The appearance then shown is an unthrifty, hide-bound condition, and rumination is very irregular or has ceased altogether. In early stages a marked constipation is present, but later on diarrhœa sets in. There is not a marked distension of the rumen, and the "pit-on-pressure" symptom of acute impaction is not present. The temperature is not elevated unless gastro-enteritis supervenes. Brain symptoms, with apparent blindness, sometimes occur. The rumen is in a state of stasis, its muscular movements being suspended. This can be recognized by placing the hand on the abdominal wall over the organ. In short, the condition is one of paresis of the stomach-walls. We have seen a number of such cases in the North Auckland district. Certain grasses, notably danthonia, appear to help in its production. In such country, in the autumn, cattle are frequently existing on what is practically innutritious fibre, and the result can scarcely be wondered at.

As to treatment, almost invariably it is found that the owner, realizing the animal to be badly "bound," has dosed it repeatedly with Epsom salts, with the usual "no result"—or, rather, with the result later on of gastro-enteritis and death. The action of Epsom salts being chiefly on the intestine, it is worse than useless in this condition. The aim from the outset must be to endeavour to restore activity to the rumen by stimulant treatment. A combination of carbonate of ammonia ($\frac{1}{2}$ oz.), liquid extract of nux vomica (1 dram), and ginger ($\frac{1}{2}$ oz.) should be given three times daily in 3 pints of gruel. If these drugs cannot be obtained, raw linseed-oil may be given daily. A plentiful supply of drinking-water must be available, and it is good practice to give $\frac{1}{2}$ lb. of ordinary salt in a quart of warm water, with the object of producing thirst. Also, a few ounces of salt mixed with treacle and given as an electuary three or four times during the day will have the same effect, and will stimulate salivary secretion.

Treatment is not always successful, as enteritis frequently sets in, ending in death. Animals showing recovery should have a change of pasture if at all possible. At any rate, some green feed must be provided, or treatment is useless. The practical method of prevention is, of course, to make provision for some green feed and plentiful water-supply in dry seasons.

IMPACTION OF THE OMASUM.

This never exists as a disease *per se*. It is found in combination with impaction of the rumen, the omasum passing into a state of inertia in sympathy with the first stomach. The contents of the omasum may also be found abnormally dry and caked in cases of inflammation of the abomasum or gastritis. The peeling of the mucous membrane of the third stomach is a *post-mortem* condition.

Where deaths have been attributed to impaction of the omasum it is extremely probable that those holding the post-mortem never looked further than the "book."

GASTRITIS AND GASTRO-ENTERITIS.

Inflammation of the abomasum and intestines is usually caused by some severe irritant. The most commonly occurring cases are due to parasites. It is also seen in certain cases of poisoning, both vegetable and mineral. Also, as previously mentioned, it is frequently the termination of severe disturbance of the anterior compartments, due to dietetic causes.

The symptoms are an alternation of constipation with profuse diarrhœa, which latter may be blood-stained. The animal usually moves but little, and grunts, indicating severe pain. A high temperature is almost always present, and the presence of fever helps to differentiate the condition.

Treatment must be according to cause. If dietetic, a dose of linseed-oil should be given, followed by demulcents such as oatmeal, gruel, or linseed. Doses of chlorodyne are also useful, but the condition is a most difficult one to relieve.

REDWATER.

The complaint receiving this name in New Zealand is purely dietetic in its etiology, and, as such, is worthy of mention in dealing with digestive troubles. Turnips fed in quantities in winter when there is a scarcity of green feed are very prone to produce it, more especially if no hay is available to balance the ration. We investigated a mortality occurring among stock last winter in which the condition was undoubtedly produced in this way.

Redwater would also appear to be induced by a certain class of pasture, and is met in cows either a few weeks before or after calving. A few months back we were asked to inquire into the cause of death of five cows which had died during a period of eight or ten days. When I arrived at the farm all carcases had been buried, and I was unable to make a post-mortem. However, one affected cow still remained alive, and her symptoms, added to the history of the other cases obtained from the owner, led me to the opinion that the deaths were due to redwater. Some days later the owner sent us word that three more deaths had occurred. Mr. J. Lyons visited the farm, and had an opportunity of making a post-mortem. He informed me that he had rarely seen redwater in such an acute form. Death had occurred in twelve hours from the time of the animals being first noticed ill. The kidneys were enormously enlarged, the centre of the organ containing over a pint of broken-down blood. The bladder was empty, as if the ureters (tubes leading to the bladder) had become blocked. The farm in question is situated in what is practically swamp country, and the ingestion of luxuriant, rank feed (tall fescue) after protracted rains no doubt was the causal factor. The condition resembles cases which occur in fen districts in England, locally known as "moor-ill."

I am not aware if the metabolic change is actually understood. Probably auto-intoxication has something to do with it. In the milder form it usually responds to treatment with salines and correction of dietetic errors. In the cases mentioned above, a change on to short, sweet pasture, with liberal hay, ended the trouble.

THE POISONOUS, SUSPECTED, AND MEDICINAL PLANTS OF NEW ZEALAND.

(Continued.)

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

LEGUMINOSAE.

THE flora of New Zealand is remarkable in containing so few genera, species, and individuals of that great family *Leguminosae*—the pea or pod-bearers—although it is the second largest family of flowering-plants, containing over four thousand genera and seven thousand species. Cheeseman (1906), indeed, considered (" Manual," p. 107) the paucity of legumes to be one of the most remarkable peculiarities of the flora. There are practically no native plants analogous to the clovers on the main islands of this Dominion, the alpine *Swainsonia*—the only approach to a herbaceous legume—being so rare as to be negligible. The family is represented by a comparatively small number of leafless broom-like shrubs, the well-known kowhai (*Sophora tetraptera*), and the kaka-beak *Clianthus puniceus*).

The kowhai is the one instance in the native flora of a suspected poisonous legume. Its affinities in other countries are certainly suspected—namely, *Sophora sericea* and *S. secundiflora* in America. The former is supposed to be one of the plants which cause " locoism " in horses. It may here be remarked that a number of poisonous plants in the wild pastures of America are termed " loco " weeds, the symptoms they occasion being termed " locoism." Regarding the New Zealand species of *Sophora*, which will probably be split up by future systematic botanists into a number of species, the only evidence the writer has as to the poisonous nature of the tree is that two persons were made very ill by eating food with a spoon made of kowhai wood. Lauder Lindsay, in his paper on the " Toot Plant," mentions it as suspicious.* Colenso (1868) states (" Essay," p. 38) that it was used as a purgative medicine by the Maoris. Wounds were dressed with the bark, which had been steeped in water. He notes that the bark is intensely bitter. Goldie (1904) states that the inner bark of the kowhai was used for pakipaki (itch) by the Maoris.

ROSACEAE.

The piripiri (*Acaena* sp.), which by its clinging burrs annually causes such trouble in lowering the value of wool, is the only plant of which anything can be said of those species belonging to this large family. The latter, however, is but poorly represented in the Southern Hemisphere. The leaves of *Acaena sanguisorbae* are used as a substitute for tea, according to Maiden (" Useful Plants," p. 4), by Australian settlers. An infusion of the plant has been found useful in preventing scour in

* Dr. Hulme (Provincial Surgeon of Otago) informed Lindsay that he suspected the wood and seeds of poisonous properties (*Brit. and Foreign Med. and Chir. Rev.*, July, 1865).

calves by settlers in the Strathmore district of Taranaki. According to Hooker ("Handbook"), it has been used medicinally by the South Island settlers, while the Maoris used it medicinally in various ways (Goldie).

SAXIFRAGEAE.

The bark of *Weinmannia racemosa* and *W. sylvicola*, the kamahi or tawhero of the Maori, contains much tannin. Up to 20 per cent. has been found to be present by modern methods of analysis in the Chemical Laboratory of this Department. The bark was very largely used by the early settlers for tanning leather. Goldie states that the bark was used medicinally by the Maoris.

MYRTACEAE.

Leptospermum scoparium, the manuka or tea-tree of the settler, is a common plant throughout New Zealand. The leaves have been used as a substitute for tea. *Metrosideros* is the genus to which the ratas and pohutakawa belong. The bark of these trees, although thin, contains a large percentage of tannin, and was used medicinally by the Maoris for various disorders (Goldie).

PASSIFLOREAE.

The fruit of the native passion-flower, *Passiflora tetrandra*, is very much relished by rats, and contains a large amount of an easily expressed oil, which is worth chemical investigation. The Maoris used the oil medicinally (Goldie).

UMBELLIFERAE.

Hydrocotyle asiatica must be regarded as a suspicious plant. Grandpré found that in small doses it is an energetic stimulant, and in large doses a narcotic producing stupor, headache, and, in some persons, vertigo with a tendency to coma. Mr. R. H. Meade, Government Veterinarian at Palmerston North, reported in May, 1922, a case of suspected poisoning in sheep by this plant at Akitio, on the Wellington east coast. The symptoms he noticed were vertigo, stupor, and falling down and struggling at times, the animals remaining in this state for about a fortnight before death. On post-mortem the livers were found creamy-looking and atrophied, and the kidneys diseased, but the carcase fat and well nourished.

The genus *Hydrocotyle* is one of world-wide distribution. In America these plants are called "water pennyworts." In England the only indigenous species is *H. vulgaris* ("marsh pennywort"). It is significant that the other trivial names are "sheep-rot" and "white rot," from its supposed poisonous effect on sheep. Long (1917) ("Plants Poisonous to Live-stock," page 93) states that it is reputed to have caused inflammation of the digestive tract and hæmaturia, and to contain a toxic substance, vellarin.

RUBIACEAE.

There are some forty species of *Coprosma* in New Zealand, which range in size from tree-shrubs to herbs. The genus belongs to a family which has given many valuable plants to mankind. In medicines may be mentioned quinine and ipecacuanha; in dyestuffs the madder and other dyes; in foodstuffs the coffee-plant—all of which are obtained from plants of this family.

It has been suggested that the New Zealand species of *Coprosma* should be examined for caffeine ; Skey (1869) did so with a negative result (*Trans. N.Z. Inst.*, Vol. 1, p. 152). J. C. Crawford (1876) (*Trans. N.Z. Inst.*, Vol. 9, p. 546) recommended the ground and roasted taupata (*C. Baueri*) seed as a substitute for coffee, stating that it has then a splendid coffee-aroma, and that when made into coffee the result seems thoroughly satisfactory. J. T. Armstrong (1891), "On Economic Plants," states that the leaves of the karamu were used as a substitute for China tea, and that the decoction is a good febrifuge.

There is no doubt as to the excellence of this genus as a source of dyes. Those species which have the inner bark coloured yield with hot water dyeing-solutions which give perfectly fast colours on wool, with and without mordants, and equal in permanence to those given by the madder (see the writer's papers in *N.Z. Journal of Science and Technology*, 1918, Vol. 1, p. 3, and this *Journal*, 1918, p. 363 ; also Perkin and Everest, "Natural Organic Colouring-matters," 1918, p. 578).

There is no group of New Zealand plants which, from a scientific point of view, offer a more alluring field for investigation to the plant chemist than the genus *Coprosma*. Not only are the species closely allied, but they exist in comparative abundance throughout New Zealand, and there is considerable evidence that different chemical compounds found vary with the species. Hence chemistry might be of value in determining the relationship of the species to one another.

The fruit of several species was eaten by the Maori. Colenso (1868) states that the root of *C. acerosa*—a littoral species—was used as an alterative by the Maoris ("Essay," p. 39). The roots of this species, which is found growing on sand-dunes, are of great length, and could easily be unearthed from the loose sand.

COMPOSITAE.

This, the largest family of all flowering-plants, contains, so far as is known, very few poisonous plants in New Zealand. *Brachyglottis rapanda* (rangiora, wharangi, or pukapuka), a characteristic shrub of the North Island, is no doubt poisonous. Baber (1886) (*Trans. N.Z. Inst.*, Vol. 19, p. 320) states that this shrub is seldom eaten by cattle or sheep, but horses are fond of it. Its effects are staggering of the legs and falling ; it is often fatal ; after death, the body is much distended. The popular remedy is to keep the animal moving. Skey (1881) (*Trans. N.Z. Inst.*) failed to isolate any active principle to which the poisonous nature could be referred. He made the interesting discovery that the resinous matter which exudes from the trunk and branches of the tree gives with alcohol acidified with hydrochloric acid a rich deep-blue colour—a reaction which has been verified by the present writer.

Colenso (1868) (*Trans. N.Z. Inst.*, Vol. 1, p. 38) states that the leaves, which are large and have a white under-surface, were used by the Maoris as a protection for wounds and old ulcerated sores. The poison of poisonous wild-honey may be due to the fact that the honey has been gathered from *Brachyglottis*, as large quantities of pollen-grains from the plant have been found in poisonous honey (Annual Report of Department of Agriculture, 1908, p. 428).

(To be continued.)

THE RABBIT PEST.

POTENTIAL INCREASE AND MIGRATION.

D. MUNRO, Inspector of Stock, Wanganui.

THE present article is contributed in the hope that my experience may be of use to settlers, particularly those situated in districts where rabbits have not yet become permanently established, and who have therefore not had the opportunity of becoming acquainted with the peculiarities and possibilities of the rabbit.

One might suppose in this country, where the rabbit nuisance has driven numbers of men off the land and has been responsible for such a great national loss, that every settler would be conversant with the subject, and at least have sufficient knowledge to effectively prevent the pest from making further encroachment on clean territory. This, however, is not the case. It is remarkable to find how little is known concerning the rabbit in districts where it has not actually become a nuisance, and I believe that it is largely due to this lack of knowledge that the pest is still permitted to spread on to new country. I am firmly convinced that if those settlers in infested areas who have had experience of the rabbit nuisance could be given the opportunity which settlers in clean or comparatively clean districts still enjoy they would go to the very limit of their resources rather than allow the pest to gain a footing. Yet in districts where there are only a few small scattered colonies one frequently hears the statement made (generally by men who have no knowledge of the subject) that rabbits will never do any harm in their particular district, the reasons given being that there is too much grass, the country is too rich or too wet, the subsoil too hard to burrow in, the country too closely settled, &c.—all reasons which I heard thirty years ago in districts which are to-day rabbit-infested areas. There is no part of New Zealand in which it is either too wet, too dry, too hot, or too cold for the rabbit to prove a very serious nuisance if given the opportunity of becoming established. It would be a very doubtful recommendation to any country to say that it will not carry rabbits.

An argument which is frequently put forward in such districts, and one which appears to carry a good deal of weight with some settlers, is that odd rabbits have been seen for many years, but that they have never increased to any extent—facts which they consider to be ample proof that for some reason or other the country is not suitable for rabbits, and that there is therefore no cause for alarm. There appears to be an impression prevalent in the minds of settlers inexperienced in the ways of the rabbit that for an invasion the pest is going to advance in massed formation of battalions and divisions. I have heard it said by settlers in infested districts that for several years there were only a few rabbits, and then quite suddenly they came on in thousands. Such statements, no doubt, are largely responsible for the mistaken idea that the pest suddenly migrates *en masse* to new country. If such were the case one would naturally expect to find a corresponding diminution on the country from whence they came, but

a diminution of this nature is never to be found. These odd pairs which appear in new country, and which to the casual observer may not be a matter of any great concern, do and always will constitute a very real and serious danger to the district in which they are allowed to exist. The slow progress made by the pest in the earlier stages of colonization gives a certain degree of confidence to the inexperienced settler, and misleads him into the belief that the country cannot be suitable. There may not be any appreciable increase for several years, but at any moment the pest may overcome certain forces which have been operating against it, and from then on will increase at an alarming rate. Such is the early history of the rabbit in almost every district in New Zealand where it has ultimately become established.

This process or period of colonization is necessarily governed to a very large extent by the opposition offered. In the early period of the rabbit in New Zealand there was little or no opposition offered to its increase. The natural enemies were few in number—stoats, weasels, and ferrets had not then been introduced—consequently the colonizing process was more rapid. Now, and for many years past, there have been and are thousands of these animals in every district in which the rabbits have sought to extend operations. The pioneers are therefore met with a much greater degree of resistance, and it may take several years before they have reached that point when they are able to satisfy all the demands of their natural enemies and sportsmen and yet have a surplus to carry on freely the process of reproducing their kind. This point may be reached as the result of several causes or by a combination of causes. Principal among the forces acting against the rabbit in the earlier stages is the natural enemy—stoats, weasels, and ferrets—all animals which are particularly susceptible to distemper, a disease which to them almost invariably proves fatal. Cats are also susceptible to this disease. It is quite possible, therefore, that as a result of an epidemic among the natural enemy, combined perhaps with a particularly favourable season, the rabbits are able to reach that point just mentioned when they have gained the balance of power—a point which will mark the beginning of the rabbit nuisance in the district concerned unless the settlers very quickly take a hand in the game.

POTENTIAL INCREASE OF RABBITS.

In order to fully appreciate the danger of the pest it is necessary to realize the extent to which rabbits are capable of increasing in a given time, and I have worked out a propagation chart showing in detail what may be considered a reasonably conservative estimate of the increase from one pair in one, two, and three years. Many authorities may be quoted in support of the figures on which I base my calculations: among others, the "Encyclopædia Brittanica"; "Treasury of Nature" (Samuel Mander); "Veterinary Posology" (Banham), p. 251; "Veterinary Obstetrics" (William), pp. 41, 43, and 47; Fleming's "Veterinary Obstetrics"; and Harmsworth's "Encyclopædia" (this latter authority stating that one pair of rabbits left undisturbed for three years would breed to over thirteen millions). All these authorities agree on the main issue—*i.e.*, the period of gestation, average litter, &c.

It may be also mentioned that personally I have had over thirty years' practical experience in dealing with the pest, during which period I have had the best of opportunities of studying the habits and peculiarities of the rabbit. My experience has not been limited to any one locality; during thirty years of departmental service I have had occasion to deal with the pest in many districts in both Islands, and in all classes of country. Moreover, I have had the benefit of exchanging opinions on the subject with hundreds of practical rabbiters and settlers full of experience.

The authorities named deal more particularly with the rabbit in European countries, but, like many noxious plants, birds, and animals, the rabbit has under the more congenial climatic conditions enjoyed in New Zealand and Australia speeded up very considerably in the matter of reproduction. There is no doubt that the number of litters which a doe will produce in a season is to a large extent regulated by climatic conditions, a dry warm season being, of course, most suitable. This point is well demonstrated in New Zealand, where climatic conditions vary a good deal. In the southern part of the South Island, where the winter months are more severe, there is a distinct break in the breeding seasons of from three to four months. In Southland, Otago, and South Canterbury there is practically no breeding from the beginning of May to the middle of August; but in parts of the North Island, particularly on the coastal country, where the winter is usually very mild, it is not uncommon to find numbers of nests and young rabbits all through the winter months. Under ideal conditions it is easily possible for a doe to have ten litters in the year (the period of gestation being twenty-eight to thirty days), and from records kept over a lengthy period I have found that the average number in the litter is six. In the early spring months the average is approximately seven, but after November, when the young does come into bearing, the average litter will be found to drop to about six. I have seen on two occasions a litter of fourteen, and litters of ten to twelve are not uncommon. During last spring I noted that in this district (Wanganui) the main breeding season commenced about the last week in August; quite a number of nests were found and destroyed, and after the first week in November the majority of young does destroyed were found to be in an advanced state of pregnancy or had already given birth to a litter.

Assuming, then, that the average litter is six, that each doe will produce in the year eight litters of equal sexes, and that the young does will breed at fifteen weeks, the total increase for the year from one pair would be 534. This total is contingent upon there being no casualties; but, allowing that from all causes 50 per cent. of this increase will become casualties before the beginning of the second year, the second breeding season would thus commence with a total of 267, plus one of the original pair = 268. Of this number half—134—are does, each producing an increase of 534 in the season: 534 × 134 = 71,556. The casualties during the second year and succeeding years would be less than in the first year, as the requirements of the natural enemy would not increase in proportion; but, allowing that the casualties still remain at 50 per cent., the third year would start with half of the previous year's increase: 35,778, plus 134 (with which the second season started) = 35,912. Half of these are does, or 17,956 does, each giving an increase of 534 in the year: 17,956 × 534 = 9,588,504.

To this must be added the number at the beginning of the season—35,912—showing a total of 9,624,416 at the end of the third year.

It will thus be seen that it is reasonably possible for one pair of rabbits to increase in three years to between nine and ten millions. This is a fact which it would be well for every settler to fix very clearly in his mind. The figures stated present an interesting problem. It is estimated that six or eight rabbits will eat or destroy as much grass as would graze one sheep; but, allowing that ten rabbits equal one sheep, it is evident that one pair of rabbits is capable of reducing in three years the stock-carrying capacity of our lands to the extent of a million sheep. This affords some indication of the enormous annual loss which the rabbit pest may represent.

CONTROL WORK.

In infested districts the main efforts for the destruction of rabbits are generally made in the winter months, when the skins are of most value, and the approximate cost of their destruction then is not less than 3d. per head. The cost of destroying 534 rabbits at 3d. per head equals £6 13s. 6d. It would therefore have paid the settler to have spent this amount in destroying the parent pair at the beginning of the season; the feed saved would represent a profit on the transaction. This point is mentioned merely to illustrate the importance of control work at the proper season of the year. Poisoning, which is undoubtedly the best and cheapest wholesale method of destroying the pest, should be carried out as early as possible in the season, and so allow as much time as possible between the poisoning and the beginning of the next breeding season. During the interval every possible effort should be made to clean up those rabbits which will not take the poison. When a general poisoning is necessary it is essential, in order to obtain the best results, that the rabbits should not be disturbed by trapping, dogging, or shooting for at least two or three months before the poison is laid. It has been my experience that where rabbits are hunted right up to the time of poisoning the results are never as good as when they are allowed to settle down for, say, two or three months before.

In a later issue of the *Journal* I propose to deal briefly with the various methods of destroying rabbits, and with other related matters which may be of interest to settlers, particularly those in districts where the pest has not yet become permanently established.

FINAL TESTS WITH "RADIO" MANURE.

THE third year's experiments with this proprietary manure at Motuihi Island, Auckland, had to be discontinued for reasons of economy, but further top-dressings were carried out during 1922 at the Albany Experimental Area. There was an increase in the weight of hay cut from the "Radio" plots over and above the check plots, but, as was pointed out in connection with the previous trials, the increase was doubtless due to the superphosphate and lime which this manure contained, as the coal-dust in each and every case depreciated the value of the other ingredients. It is clear, reviewing the trials, that "Radio" would be a better fertilizer if the coal-dust were left out. Coal-dust apparently has no value as a fertilizer. Reports on the first and second year's experiments were published in the *Journal* for March, 1921, and January, 1922, respectively.

—*T. H. Patterson, H.D.A., Instructor in Agriculture, Auckland.*

LEAF-CURL, BLADDER-PLUM, AND CHERRY-CURL.

THEIR APPEARANCE, CAUSE, AND CONTROL.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

(1.) LEAF-CURL, *TAPHRINA DEFORMANS* (FCL.) TULASNE. Synonyms: *Exoascus deformans* (Berk.) Fcl.; curl, curly-leaf, leaf-blister, peach-blister, peach-curl.

LEAF-CURL occurs throughout the world wherever the hosts are grown. It is common on peaches and nectarines, but is not confined to these hosts, as in New Zealand it has been found on almonds and apricots, being not uncommon on the latter host.

It is essentially a climatic disease. In dry seasons its effects may be slight, but if during the blossoming-time of the host the weather conditions are such that a cold and wet period is followed by a warm, mild, and humid one, then infection is usually severe. This severity varies according to the susceptibility of the host, as in a season favourable to the disease certain varieties may suffer very little, whereas others may be completely defoliated. For instance, the peach variety Paragon is very susceptible, and the disease may on th' host persist throughout the growing season. The following varieties, too, are susceptible: Alberta, Kia Ora, Briggs's Red May, Carmen, Kalamazoo, Mamie Ross, Triumph, Wiggins, American Pound, and all varieties of nectarines. Those less susceptible are Hobbs's Royal, Charlotte, Hales's Early, and Saunders.*

This data as to the relative susceptibility of different varieties has little value, however, as a variety more or less immune in one country may be very susceptible in another. For example, in Australia the peach varieties Briggs's Red May, Early Crawford, and Solway are all resistant, whereas in North America they suffer severely. Seedling peaches are generally susceptible, as is shown by the virulence of attack by this disease on the old "Maori" peach at one time so common throughout the North Island of New Zealand.

ECONOMIC IMPORTANCE.

Leaf-curl may reduce the crop in several ways, or it may cause a total loss, according to the severity of attack. (1.) Following infection, the foliage may be partially or even entirely destroyed, and as a result a second crop of leaves be produced. This results in a weakened tree, which becomes more susceptible to attack from other diseases. It is doubtful, moreover, whether a full crop will be borne the following season, as when defoliation has been severe little growth is made, and in consequence, owing to the fewer number of fruit-buds formed, the crop is a light one. (2.) Again, as a result of defoliation the tree may fail to set any fruit; or, should they set, fruits do not reach maturity,

* Data supplied by Mr. W. H. Rice, Orchard Instructor, Hastings, of the varieties variously affected in Hawke's Bay.

but remain small and stunted, and are often disfigured by large cracks. (3.) Laterals may be killed outright, and loss of fruit (otherwise borne on these laterals) consequently follow. (4.) Where infection occurs year after year the tree eventually may be killed outright.

FIG. 1. LEAF-CURL ON PEACH. HALF NATURAL SIZE.

[*Photo by W. D. Reid.*

On nursery stock defoliation may be followed by the death of the trees, or, at least, growth will be poor and weakly. Then, too, trees thus infected are certain to carry the disease from the nursery to the locality where they are to be planted.

APPEARANCE AND EFFECT ON THE HOSTS.

Leaf-curl infects leaves, shoots, blossoms, and fruits. Infection occurs shortly after the leaves have unfolded from the bud, when they appear somewhat curled and blistered. The midrib becomes swollen

and curves inwards at its extremity, and the petiole becomes thickened and distorted. This is accompanied by gradual change in colour of the attacked parts. At first green, these change to yellow, and may later become deep-red. At the same time the leaves become much distorted, broadened, and thickened, and are at this stage much folded (Fig. 1), convoluted, and very brittle. On the upper surface of these blistered areas a delicate bloom may be seen, due to the appearance of the fructifications of the causative organism. Finally, infected leaves die and turn brown, and either fall to the ground or remain

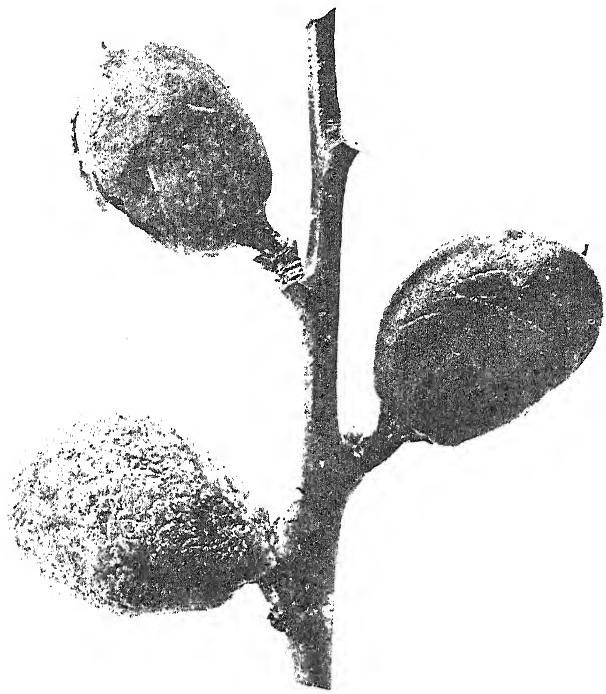


FIG. 2. LEAF-CURL ON NECTARINE FRUITS. NATURAL SIZE.
Infected fruit is scabbed and slightly larger than normal (lower left).
[*Photo by G. H. Cunningham.*

attached to the lateral, forming small bunches, which doubtless afford suitable shelter for insect pests and possibly the spores of other fungi. Following infection and death of these leaves, others are produced which generally escape attack ; but at times, especially if the season is cold and wet, these may in turn be infected, when smaller and less conspicuous blisters are formed; and in exceptional cases leaf-curl may persist on certain varieties during the whole of the growing season.

Infected shoots become somewhat thickened, and often curved and distorted ; they also change in colour, often becoming light-green or even yellow. As infection frequently occurs while they are quite small

and partly grown the shoots become stunted, so that the leaf-buds are much closer together than normally; consequently, when leaves are produced they appear so compacted together that the shoot assumes a rosetted form. Infected shoots become weakened, and in many instances may be killed outright. Die-back of the tips of laterals is a common manifestation of leaf-curl. When blossoms are infected the petals become variegated, and are usually larger in size and much crinkled; more frequently, however, the blossoms die and fall to the ground.

Young fruits when infected become much distorted, owing to the portions becoming greatly enlarged. Such fruits seldom remain long on the tree, as they become scabbed and cracked, and soon fall. Maturing fruits are commonly attacked—this phase of the disease being more common than is generally recognized—and as a result swollen irregularly shaped areas, usually bright-coloured, appear on the surface. These areas are much wrinkled (Fig. 2), and on peaches often appear as if polished, owing to the absence of those hairs which normally cover the surface. They are conspicuous on the fruits of the nectarine, as the bright coloration gives a false impression of maturity. Fructifications may develop on these areas, appearing as a delicate bloom; they are unusual, however.

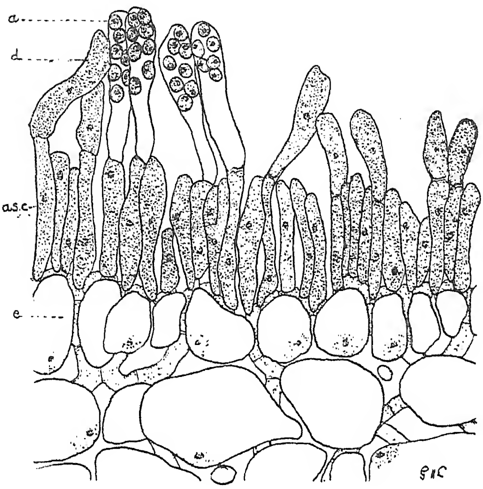
LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

Leaf-curl is caused by *Taphrina deformans* (Fcl.) Tul.,* a fungus that differs from those discussed in previous articles of this series published in the *Journal* (see July and August last), in having only one spore-stage (Fig. 8) in its life-cycle. It differs again in that the asci are exposed at maturity and not enclosed in a receptacle, and so is, by mycologists, considered to be a more primitive form.

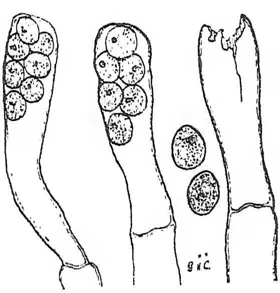
The leaves become infected shortly after they emerge from the bud, the hyphæ of the fungus growing between the leaf-cells; the cells are not killed at this stage, but are stimulated to further growth. The hyphæ absorb their necessary food-substances from the leaf-cells, which in consequence become greatly altered; the chlorophyll (green colouring-matter) is absorbed, and the cell-walls become thickened, so that the leaf changes colour and increases in size, becoming broader, thicker, and much blistered. From the leaves hyphæ may grow down the petiole (leaf-stalk) into the shoot to which the leaf is attached, which in turn is infected, and as a result becomes discoloured and swollen. As a rule the current season's shoots only are infected, but on rare occasions the fungus penetrates into the tissues of one-year-old shoots.

Following penetration of the leaf-tissues large hyphæ develop just below the epidermal cells of the upper surface. From these arise hyphal branches which penetrate between the cells of the epidermis and lie immediately below the cuticle, and there form a closely woven mass of mycelium. From this the asci arise as upright cells beneath the cuticle, and, as they develop, a blister becomes formed owing to the

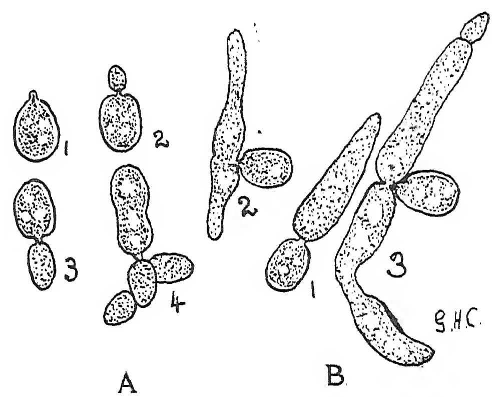
* This organism is so widely known as *Exoascus deformans* that the writer hesitates to use any other name. Unfortunately, no satisfactory classification of this group exists, so that until one is forthcoming he believes it advisable to retain this and the two following species under the original generic name *Taphrina*.



8



9



10

FIG. 8. SECTION THROUGH BLADDER-PLUM. × 500.
(*a*) Asci; (*d*) immature ascus; (*e*) cells of epidermis.

FIG. 9. ASCI AND ASCOSPORES. × 1,000.
Empty ascus on right.

FIG. 10. ASCOSPORES GERMINATING. × 1,000.
A. Ascospores producing conidia (buds). B. Ascospores producing hyphæ.
[*Original.*

cuticle being raised; this becomes ruptured, and the asci are seen closely packed together (Fig. 8). A mature ascus is cylindrical in shape, is flattened at the apex (Fig. 9), and contains eight one-celled colourless spores (Fig. 9).

Finally the ascus becomes ruptured at the apex and the spores are liberated. On germination, these ascospores may either produce

a short germ-tube (Fig. 10, *b*), or give rise to numerous minute conidia by budding (Fig. 10, *a*). Budding may occur in the ascus either before spore-discharge, or upon the leaf-surface after, when the upper surface of diseased leaves becomes coated with these conidia, appearing as if covered with hoar-frost. With the production of these spores our knowledge of the life-history ceases. It is not known where the spores remain until they cause infection the following spring, or the method of infection, or the part played by mycelium located in the shoots in the perpetuation of the disease. But from field observations a fair idea as to the subsequent behaviour of the organism may be obtained. Thus it appears that in the majority of cases infection of the leaves as they unfold from the buds is due to spores—whether ascospores or conidia (buds) is unknown—carried over the summer and winter months in bud-scales and crevices in the bark; and that perennial mycelium plays a minor part. This assumption is based on the readiness with which the disease may be controlled by spraying, as a single application at the proper time results in almost complete control. Such a condition could not be obtained if infection were due to perennial mycelium, as the spray would not destroy the mycelium which is protected by the tissues of the shoot. In consequence it is assumed that the spores are lodged in bud-scales and bark-crevices, and that they infect the young leaves as they emerge from the bud, so that a spray applied before the buds unfold destroys these spores, and this prevents infection. The fact must not be lost sight of, however, that perennial mycelium does play a part in infection, as in certain instances where trees have been carefully sprayed slight infection may persist; or, again, with certain varieties, notably Paragon, this disease cannot be effectively controlled by spraying alone. Infection may be severe, and persist throughout the whole of the growing season. This would tend to show that with this variety, at any rate, mycelial infection is a serious factor, and control in such a case calls for additional treatment.

(2.) BLADDER-PLUM, *TAPHRINA PRUNI* (FCL.) TULASNE. Synonyms: *Exoascus Pruni* Fcl.; plum-pockets.

Bladder-plum is world-wide in its distribution, occurring wherever the hosts are grown. In New Zealand it is confined to the plum, but in North America it has been recorded on *Prunus virginiana*, and in North America and Europe on the bird-cherry, *Prunus Padus*. All varieties of cultivated plums appear liable to infection, but in New Zealand it appears, as a rule, only on the so-called Japanese plums, although English plums are occasionally infected.

ECONOMIC IMPORTANCE.

As this disease is confined to plums, it may be claimed that its importance is slight, owing to the fact that plums do not figure among the more important commercial fruits. Nevertheless, to those growing these fruits its attacks may prove serious enough, for where infection is severe the greater part of the crop may be lost. As leaves, too, are attacked, partial defoliation and consequent debilitation of the tree may follow. Furthermore, shoots may be stunted, and in cases of severe infection killed outright.

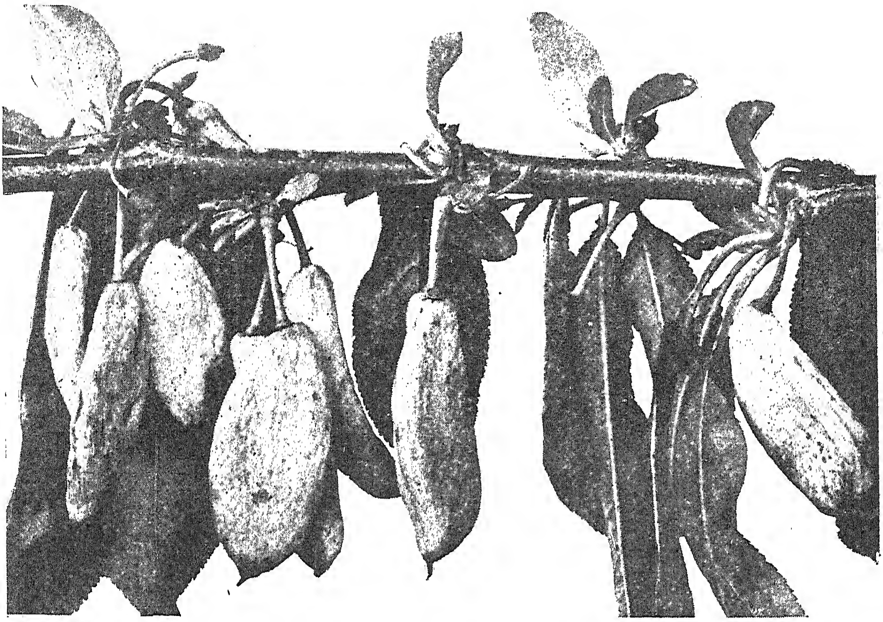


FIG. 3. BLADDER-PLUM ON JAPANESE PLUMS. NATURAL SIZE.

[*Photo by W. D. Reid.*

FIG. 4. BLADDER-PLUM ON ENGLISH PLUMS (EVANS'S EARLY). NATURAL SIZE.
Normal plum on left. Dark spots on infected fruits are red in nature

[*Photo by G. H. Cunningham.*

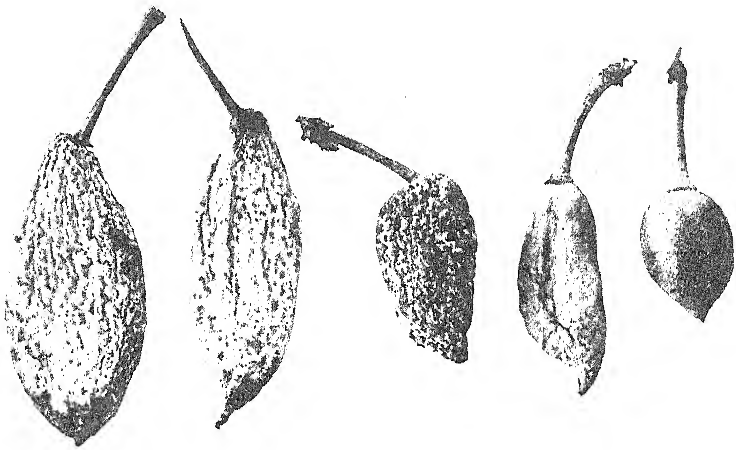


FIG. 5. BLADDER-PLUM (JAPANESE VARIETY). NATURAL SIZE.

Showing gradual development from normal fruit (on right) to severely infected fruits.

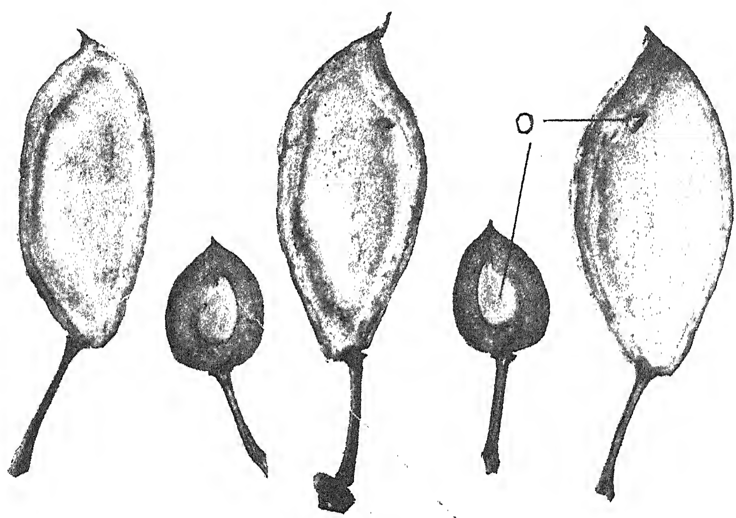


FIG. 6. BLADDER-PLUMS IN SECTION. NATURAL SIZE.

Normal fruits between the three infected specimens. Note remains of ovule (*o*), and compare it with normal ovule.

[*Photos by W. D. Reid.*

APPEARANCE AND EFFECT ON THE HOSTS.

Bladder-plum infects leaves, fruits, flowers, and shoots, but is most noticeable on the fruits about three weeks after blossoming; these become greatly enlarged, and after a time fall to the ground.

These enlarged fruits are at first somewhat globose, eventually becoming greatly elongated, and more or less curved and twisted (Fig. 3). They are spongy in texture, and when cut open are seen to be quite hollow, the stone and ovule (seed) not being developed (Fig. 6). They change in colour from green to white: at first somewhat smooth, they soon become much wrinkled. Finally they turn brown and die. Infected fruits on English plums present a slightly different appearance. Infected fruits do not become larger than normal ones, but differ mainly in colour, being white blotched with red (Fig. 4). They are quite soft and hollow, however.

The leaves become infected shortly after they unfold from the bud, when they appear blistered and yellow or even red, resembling leaves of peaches infected with leaf-curl. They, too, after a time change to brown and fall to the ground.

Shoots are invariably attacked, when they appear lighter in colour and much swollen. They frequently become stunted, when the leaf-buds remain close together, and give a rosetted appearance to the branch; or they may be much twisted and killed for part of their length. Following the death of these laterals, small and weakly secondary laterals grow out immediately below the dead areas; these in turn become infected, and produce a further crop of diseased fruit the following season.

Blossoms are sometimes killed outright shortly after they emerge from the bud, but this is an uncommon manifestation, and doubtless occurs only when climatic conditions are favourable to the active development of the causative organism.

LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

Bladder-plum is caused by *Taphrina Pruni* (Fcl.) Tul., a fungus included in the same genus as that causing leaf-curl. In fact, the life-histories of both, so far as is known, are similar.

The hyphæ of the fungus are perennial in infected shoots, and in the spring grow through the pedicel into the developing fruits, where they ramify through the mesocarp (fleshy part of the fruit) and stimulate this portion to excessive growth. Consequently, within a few days infected fruits become doubled or trebled in size (Fig. 5). Growth of the stone and ovule (seed) is prevented; consequently, infected fruits are soft throughout and quite hollow (Fig. 6). Shortly after infection fructifications appear as a delicate bloom on the surface of these "bladder-plums." Doubtless leaves and developing shoots are infected in a similar manner, although infection may occur equally well from spores lodged in the bud-scales and bark-crevices. This would, in part, appear to be borne out by the fact that the effects of the disease can be somewhat reduced by one spray application; but that perennial mycelium plays a part in the perpetuation of the disease is obvious when one considers the fact that the latter cannot be entirely controlled by spraying as in the case of leaf-curl.

The mycelium continues to traverse the young shoots as they develop, so that once a branch has become infected the disease will persist in infected shoots until such time as they are removed.

(3.) CHERRY-CURL, *TAPHRINA MINOR* SADEBECK. Synomyms: *Exoascus minor* (Sad.) Sacc.; cherry leaf-curl, cherry leaf-blister.

This disease would appear to have a limited distribution, so far having been recorded only from Germany and the south of England. In New Zealand it has been found only at Havelock North (in Hawke's Bay) and Roxburgh (in Central Otago), and is confined to a single orchard in each of these localities. In the orchard at Havelock North four cherry-trees are infected—two of the variety Black Tartarian, one Early Purple Guigne, and one unknown variety.* In the Roxburgh orchard three trees of an unknown variety are infected. Although in New Zealand the disease has been found only on the cherry (*Prunus cerasus*), in Germany it has been recorded on an additional host,

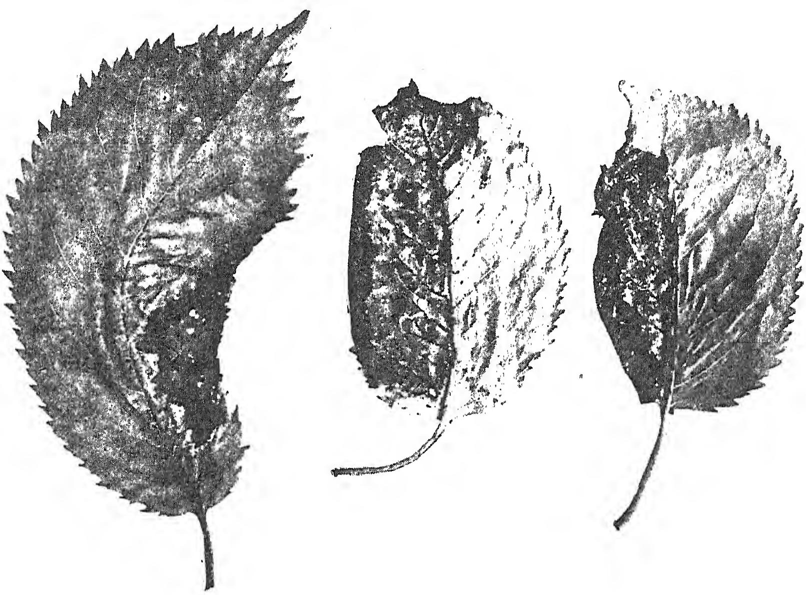


FIG. 7. CHERRY-CURL ON UPPER AND LOWER LEAF-SURFACES. NATURAL SIZE.
[*Photo by G. H. Cunningham.*

the ground-cherry (*Prunus Chamaecerasus*). Doubtless this limited distribution is more apparent than real, and the disease mistaken for leaf-curl, as in many publications the cherry is cited as a host of this disease. It differs considerably from leaf-curl in microscopic characters, however, as well as in inability to infect any host other than the two mentioned.

APPEARANCE AND EFFECT ON HOST.

In New Zealand the distribution of cherry-curl is so limited that the disease is scarcely worth more than brief mention here, yet should it spread it may prove to be quite a serious disease of cherries.

* Data supplied by Mr. W. H. Rice, Orchard Instructor, Hastings.

Fortunately, there appears to be little danger of its becoming widespread. The disease has been known to exist for several years in the two local orchards concerned, and yet has not spread to trees in adjoining orchards nor to adjacent trees in the same orchards.

Cherry-curl infects leaves and shoots. On leaves brightly coloured blistered areas appear (Fig. 7) which so resemble those formed by leaf-curl as to be readily mistaken for it. The leaves then turn brown and fall off. A peculiar feature of the disease is that it does not attack all leaves on a branch, but merely one or two here and there. Then, too, as a rule the whole leaf is not attacked as in the case of leaf-curl, but the infected areas are limited to one half of the leaf, and in consequence the leaf-tissues and petiole are often curved so that apex and base point in the one direction (Fig. 7). Infected branches in a season or two become stunted, make little new growth, and produce few or no blossoms, due no doubt to the effects of partial defoliation.

LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

Cherry-curl is caused by *Taphrina minor* Sadeb., a fungus belonging to the same genus as that causing leaf-curl, its life-history being similar to that of the latter organism. The mycelium of the organism hibernates in the dormant buds and in the cuticle of infected shoots, so that when growth commences in the spring the leaves become infected as they emerge from the buds. The mycelium extends into young shoots as they develop, and then penetrates the tissues of the forming buds. Following infection, the mycelium penetrates between the cells, causing them to become enlarged, and so the blistered areas are formed. On the under-surface of these blisters the asci appear, and in them the spores are produced. Although the young shoots are infected, they do not appear to become distorted and discoloured as is the case with leaf-curl, possibly because the mycelium does not penetrate farther than the cells of the epidermis. Spores produced on diseased leaves do not appear to be capable of spreading infection, as the disease in the localities mentioned has not spread to adjacent trees. Moreover, although these infected trees have been regularly sprayed, the disease appears year after year, these two facts clearly indicating that it is perpetuated by perennial mycelium alone. Such being the case, cutting-out of infected branches would appear to be the only preventive treatment that can be recommended. This presents a certain amount of difficulty owing to the danger of causing excessive gumming, but if cutting-out of branches was performed as soon as growth commenced in the spring this danger would be obviated.

One other disease of the cherry, witches-broom, *Taphrina Cerasi* (Fcl.) Sadeb., caused by a species of fungus belonging to the same genus as leaf-curl, is worthy of mention here. It causes large, tufted masses of laterals to appear on the host. Fortunately, so far as the writer is aware, it does not occur in New Zealand.

GENERAL CONSIDERATIONS.

It has been shown in the foregoing matter that leaf-curl, bladder-plum, and cherry-curl may be spread either by ascospores (or their resultant conidia or buds) or by perennial mycelium overwintering in infected shoots and buds. In the case of leaf-curl these spores appear

to winter over in bud-scales and bark-crevices, and to infect the leaves and fruits as they emerge from the buds. It appears from the ease with which leaf-curl on most varieties is controlled by spraying that infection is due almost entirely to these overwintering spores. With certain varieties, however, perennial mycelium plays an important part in the perpetuation of leaf-curl.

The case of bladder-plum differs somewhat, as it is probable that extensive infection, especially fruit-infection, is due to perennial mycelium situated in the shoots. This belief appears to be strengthened by the increasing difficulty of control, for it must be admitted that more than 75 per cent. of clean fruit cannot be obtained by spraying alone.

With cherry-curl, again, spraying has little effect on its control; and as it appears year after year on the same trees, and does not appear to spread (in New Zealand) to adjacent trees of the same variety, it is obvious that here the organism is perpetuated solely by perennial mycelium.

It may thus be seen that although perennial mycelium plays a minor part in the spread of leaf-curl (if those varieties are excepted in which the disease persists despite spray treatment) it is an important factor in the spread of bladder-plum, and is (in New Zealand) entirely responsible for the spread of cherry-curl.

CONTROL.

(J. A. Campbell, Director of the Horticulture Division, Wellington.)

For the control of leaf-curl and bladder-plum the following spray treatment is recommended: 5–4–50 bordeaux or 1–15 lime-sulphur, applied when the buds begin to swell, but before they open. When the regular schedule for brown-rot control is followed, the first spray will also control leaf-curl.

The spray treatment should be supplemented by cutting out infected shoots. This would apply to those varieties on which leaf-curl persists despite spraying, to all varieties of plums infected with bladder-plum, and to cherries infected with cherry-curl. Cutting-out could be practised at any time during the growing season (except with cherries), as the disease would be conspicuous and consequently readily located. In the case of cherries, cut out infected branches shortly after growth has commenced in the spring, and so obviate gumming. Paint wounded surfaces with coal-tar as soon as made, using a stiff brush. Shoots and branches need not be cut back to a greater distance than 2 in. below the point of visible infection, as the mycelium does not readily grow downwards into larger shoots.

SUMMARY.

(1.) Leaf-curl, bladder-plum, and cherry-curl are caused by *Taphrina deformans*, *T. Pruni*, and *T. minor* respectively.

(2.) Leaf-curl infects leaves, shoots, blossoms, and fruits, causing leaves to become enlarged and distorted, shoots to become swollen and frequently killed, blossoms to become large, crinkled, and variegated, and fruits to become cracked and blotched. It attacks almonds, apricots, nectarines, and peaches.

(3.) Bladder-plum infects leaves, shoots, blossoms, and fruits, causing leaves to become blistered, shoots to become distorted, buds to fall, and fruits to become swollen and quite hollow. It is confined to plums.

(4.) Cherry-curl infects leaves and shoots, forming distorted and dead areas on the leaves, and stunting the shoots. It is confined to the cherry.

(5.) Leaf-curl usually may be controlled by one spray application applied just before the buds open. Where infection persists through the season, spraying should be supplemented by the cutting-out of infected shoots.

(6.) Bladder-plum can be only partially controlled by spraying, so that cutting-out of infected shoots should be practised.

(7.) Cherry-curl cannot (in New Zealand) be controlled by spraying. Cutting-out of infected shoots is the only treatment that can be recommended.

(8.) Each disease is confined to the hosts mentioned, and cannot infect any other host.

LITERATURE CONSULTED.

HESLER, L. R., and WHETZEL, H. H. 1917. Leaf-curl, *Manual of Fruit-diseases*, New York, pp. 277–83. Pockets or Bladders, *l.c.*, pp. 373–77.

MCALPINE, D. 1902. Peach Leaf-curl, *Fungus Diseases of Stone-fruit Trees in Australia*, pp. 13–20. Melbourne.

PIERCE, N. B. 1900. Peach Leaf-curl, its Nature and Treatment, *U.S. Dept. Agr. Bull. 20*, pp. 1–204.

SALMON, E. S. 1908. Cherry Leaf-curl, a New Cherry-disease. *S.E. Ag. Coll., Wye. Rept. on Economic Mycology, 1908*, pp. 74–77. Ashford.

THE REGRASSING EXPERIMENTS IN CENTRAL OTAGO.

REPORT BY SPECIAL COMMITTEE.

THE report here published relates to the research work concerning which a series of articles by Dr. L. Cockayne has appeared in the *Journal* under the main title of "An Economic Investigation of the Montane Tussock-grassland of New Zealand." Dr. Cockayne supplies the following note, which serves to further explain the incidence of the report :—

Before commencing the regrassing experiments in Central Otago Mr. J. L. Bruce (Department of Agriculture) and myself, after consultation with Mr. R. K. Smith (Morven Downs, Tarras) and Mr. D. Middleton (Northburn Station, near Cromwell), had the good fortune to persuade these two experienced runholders to form, along with us, a small committee. On 2nd November, 1922, this committee and a few runholders and others interested in the experiments, at my invitation, paid a visit of inspection to the experiment plots on the Dunstan Mountains, when every plot was visited and examined. Before the inspection I invited the committee—myself, of course, standing out—to supply a report for the Director-General of the Department of Agriculture giving their

candid opinion concerning the results of the experiments. This they kindly consented to do, and their views, as embodied in the report, may be noted. I wish to take this opportunity of thanking the members of the committee for their advice and encouragement at all times, and especially the local members, Messrs. Smith and Middleton, to whom I can never be sufficiently grateful for their welcome assistance and many kindnesses. [Previously I had given in three articles in the *N.Z. Journal of Agriculture* (June, July, and September, 1922) a full account of the regrassing experiments, dealing with the problem to be solved, the methods used for its solution, and the results of the experiments up to May, 1922. Those interested will find in these articles many details which could not be supplied by the committee.]

The accompanying photo, apart from its more special purpose, gives a good idea of the type of country on which the experiments are being carried out.

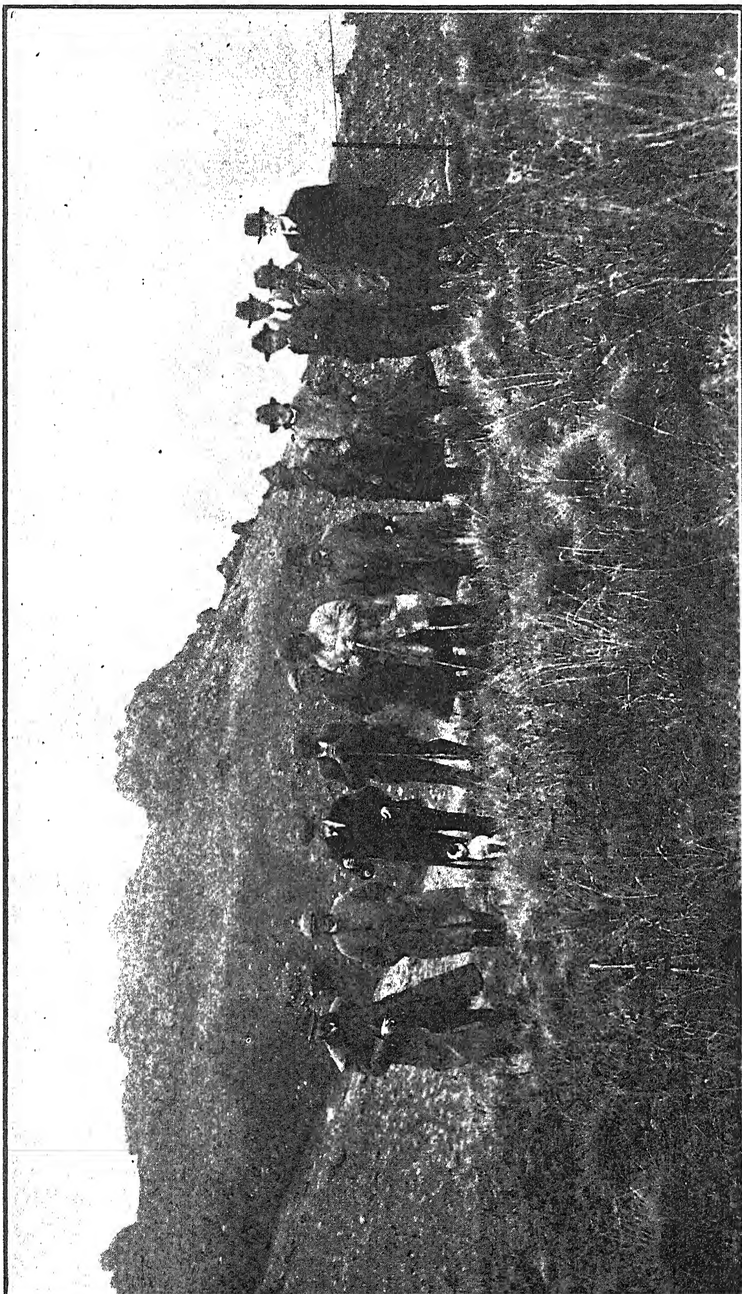
THE COMMITTEE'S REPORT.

As a result of a report by Dr. L. Cockayne, F.R.S., on the mountain grasslands of New Zealand, the Department of Agriculture recognized the importance of investigating the possibility of arresting the depletion which is taking place over a large area in Central Otago, and accordingly he was authorized to carry out the experiments under review in this report. The importance of the investigation can be realized when it is pointed out that in Central Otago almost total depletion has taken place over extensive areas of country ranging up to 2,500 ft. altitude, while from that level up to 3,500 ft. depletion is rapidly proceeding under present conditions. The total area affected can be broadly estimated at three-quarters of a million acres.

The complete history of the experiments has been recorded by Dr. Cockayne in a series of articles which appeared in the June, July, and September, 1922, issues of the *New Zealand Journal of Agriculture*, so that the report of this committee need deal only with the general results found to exist when its members made an inspection on 2nd November, 1922—two years and eight months after the plots were fenced, and two years and five months after the first sowing was made. *The fact of the inspection taking place so soon after* the enclosing and sowings requires noting, as also the fact that the years 1920–21 were both unfavourable seasons, being dry and windy and having long periods of frost in winter. As for the climate of the six months previous to our visit, there were continuous frosts throughout the winter, while the one rain falling on the frozen surface merely led to erosion, and no water reached the subsoil. The three months of last spring, too, were absolutely rainless. The plots, then, were visited under extremely unfavourable conditions.

Briefly stated, the experiments consist of fifteen plots ranging from, say, 800 ft. above sea-level to 2,600 ft., and situated on the north-western spurs of the Dunstan Mountains, where practically complete absence of vegetation occurs up to close on 3,000 ft. These plots were carefully fenced during the summer of 1919–20, and the first surface-sowing took place in the late autumn of 1920.

The most striking results noted at the inspection were: (1) The establishment of surface-sowing, which in most cases equalled the raked method, in so short a period at every elevation and aspect (except the worst wind-swept ridges) of certain valuable permanent pasture plants and grasses, especially lucerne, yarrow, sheep's burnet, chicory, cocksfoot, tall fescue, Chewings fescue, *Poa laxa*, perennial



PARTY OF INSPECTION ON THE NORTHBURN RUN, 2/11/22.

The party is standing in experimental plot 12, about 2,600 ft. altitude. Among the vegetation is seen rejuvenating blue-grass and tall blue-tussock, and sown yarrow and cocksfoot. The white patches on the depleted slopes in background are scabweed. Dr. Cockayne on extreme right.

[*Photo by W. D. Reid.*

rye-grass, and couch-grass; (2) that survival or regeneration of native grasses and other plants has taken place *slowly* on exposed ground originally swept bare of roots, &c., but *rapidly* on more sheltered ground; this regeneration is taking place at all altitudes, but it is most marked in the highest plots; (3) that outside the netted plots the most complete depletion exists, so as almost to suggest absolute sterility of the ground.

In comparing this state of affairs with the recovery of plant-life inside each plot the following conclusions only are possible; moreover, they are backed by years of experience, so that we are convinced—(*a*) that under present conditions depletion is proceeding rapidly in all the dry area of Central Otago; (*b*) that no improvement is possible without subdivision, exclusion of rabbits, and a regular system of spelling the country; (*c*) that immense improvement can be effected in a comparatively short time by surface-sowing *if rabbits and sheep are excluded* and the country spelled systematically; (*d*) that by spelling without surface-sowing great improvement will take place, but progress will be slower.

As a result of these experiments we consider that it has been demonstrated beyond doubt that the pastoral land of Otago and New Zealand generally can be economically developed to the advantage of the State and the individual by improved methods of husbandry. The necessary reform would mean capital expenditure by the land-holder for fencing to exclude rabbits, together with further fencing to subdivide his holding in order to facilitate summer spelling, &c. It means also understocking for a number of years in order to eventually greatly increase the carrying-capacity of his land and the quality of his stock. As an inducement to do this the holder must have an incentive in the shape of absolute ownership of all the improvements he effects, both visible and invisible, together with absolute security of tenure.

Although the experiments have already taught a good deal, there is still much to be learned, and we emphatically urge that the work be continued and vigorously prosecuted. Only the possibilities of comparatively few plants have been tested so far. We understand that Dr. Cockayne proposes to bring into this country seeds of many other pasture-plants from various parts of the world likely to be of value for the work, especially those growing in lands where the conditions are similar to those of Central Otago (*e.g.*, parts of Patagonia), and we are strongly in accord that every encouragement and assistance should be given to his efforts in this regard.

In conclusion, we wish to put on record our appreciation of the extremely valuable work that has been carried out by Dr. Cockayne and his assistant, Mr. W. D. Reid, of the Department of Agriculture. Their energy and enthusiasm in this matter have been beyond praise.

D. S. MIDDLETON.
R. K. SMITH.
J. L. BRUCE.

Fiji Lemon-weevil.—Steps are being taken to have this insect (which was described in last month's *Journal*) declared under the Orchard and Garden Diseases Act, and to add it to the Fifteenth Schedule of the Act.

TOMATO-DISEASES.

BLACK-STRIPE AND ITS CONTROL.

W. H. TAYLOR, Horticulturist, Wellington.

THAT enormous losses caused by diseases are experienced every year is known to all who are interested in tomato-culture. That these losses are largely the result of errors in practice, and are preventable, is a dictum not so readily accepted. That, however, has been the constant opinion of officers of the Department of Agriculture, and advice given has been based on this belief. Of course, a mere academic opinion unbased on practice is not entitled to unqualified credence, but this has not been expected nor necessary. The advice given has been founded on facts ascertained by practice, and confirmed year after year.

There is one thing that appears to have escaped notice, or if it has been noticed it has not conveyed the lesson it should—namely, that when an epidemic of disease occurs in a district there are always some growers whose plants are not affected, while with others the infection is in varying degrees of intensity. Why is it, where natural conditions are practically the same, that the amount of infection should vary so much? The answer must be that it is due to different treatment. The tomato-plant is naturally a very strong-growing subject; even on poor soil it makes a great growth. It would be reasonable to expect that, knowing this to be the case, growers would refrain from the use of manures and fertilizers that can do nothing but encourage green growth, yet that is exactly what many do not do. It will be contended that a good crop cannot be got from a weak plant. This is granted; but is there danger of getting weak plants on the good soil that is invariably employed for the tomato crop? Even if this danger existed, a more moderate amount of growth-producing manure or fertilizer should be used, and this be supplemented with a fertilizer that directly affects the fruit — namely, sulphate of potash. This latter fertilizer steadies the growth, and makes the tissues stiffer; it carries on growth over a longer period; and it directly affects the growth of fruit and its quality, making it firmer.

Recently a serious outbreak of black-stripe disease in the Hutt Valley (Wellington) was investigated. A plantation where a liberal amount of stable manure had been ploughed in is apparently doomed to extinction. A light dressing of sulphate of potash had been given, but evidently not enough to counteract the growth-producing and softening effect of the manure, the plants being very green and sappy-looking. On the same property another plantation had been given a similar dressing of stable manure, and, in addition, a fairly heavy dressing of blood-and-bone and a heavy dressing of sulphate of potash. In this case there was no black-stripe, the potash evidently having been sufficient to stiffen the plants, which, however, had a very gross overfed appearance, showing evidence of waste of money, and presenting an unthrifty appearance. Another property near-by was inspected where the plantations of tomatoes are more extensive, there being four lots on different parts

of the property. Among all these thousands of plants there was not the slightest sign of disease. No stable manure is used here, the fertilizers used being blood-and-bone and sulphate of potash.

Surely this is convincing evidence; and, further, it may be noted that the owner of this property is considered to be one of the best tomato-growers in the Hutt Valley, and that he has never in many years' practice had any more than trifling losses from disease of any kind. The evidence is clear that stable manure is bad for tomatoes, unless a crop such as cabbages is taken before the tomatoes are planted. Also blood manure is bad, being solely nitrogenous; but blood-and-bone is safe, the bone being a phosphate, and the blood-content being of a different character to pure blood.

One of the difficulties that have to be contended with in a propaganda of this kind is that it can be said that the very things we hold should not be done are often done and no ill effects follow. That, however, is an aspect of the case that has not at any time been overlooked. The effect of high feeding or of the use of the wrong material may not be felt in a dry season, because only a part of it becomes available. It is when heavy or unseasonable rains occur—and that may be at any time—that bad effects are experienced. The rainfall or muggy weather is then blamed, and the real cause is not recognized.

Quite recently reports from other countries have come to hand which support the views we have long been promulgating. One of these on "Black-stripe of Tomatoes," by Dr. R. E. Stone, O.A.C., Guelph, in the *Canadian Horticulturist*, may be here usefully reproduced (slightly abridged), as follows:—

Character of the Disease.—The first symptoms of the disease are a decided curling and twisting of the upper leaves and youngest portion of the stem, together with a hard, harsh, leathery feel of the older leaves. Suddenly brown sunken lines appear in the young vigorously growing stems, and these lines increase in width until the whole upper part of the stem may appear brown. At first the browning seems to be on the surface only, but becomes deeper-seated, and in bad cases involves wood-ring. At the same time that these streaks appear on the stem brown angular spots appear on the leaves between the veins, and these brown spots increase in size until the whole leaf is involved. Brown streaks also appear on the veins and leaf-stalks. The fruit sets very sparingly, often not setting at all on the first three or four trusses. The fruits that do set are commonly scabby, deformed, and of poor flavour and colour. So far, the disease has been noted in plants that had been growing very rapidly. Such plants very generally had thick, sappy stems and very large sappy leaves. If the bases of the stem were hard and small the trouble became much more serious.

Experimental Work.—Preliminary experiments showed that the trouble bore some relation to the soil, and it was thought that steaming the soil might prevent the disease, but this has proven unsatisfactory. Since the disease very frequently appeared on tomato-plants grown on soil that had never produced tomatoes before, and since it was always very bad on plants grown in very rich soil, it appeared that the plants were not properly fed, and that the disease might be controlled by the use of proper fertilizers. It was found possible to produce the disease at will by using fertilizers very rich in nitrogen, such as barnyard manure in excess, and ammonia or nitrates. If acid phosphate or potash was used in addition the plants made healthy growth. Even in those cases where the plants already showed a large amount of winter blight it was found that by applying acid phosphate and potash the plants recovered and made healthy growth within ten days after the application. Furthermore, the fruit set as the disease showed, and a fair crop was borne. When acid phosphate and potash were applied at the time of transplanting, or before the disease appeared, the plants were strong, vigorous, and healthy, and set a crop nearly twice as heavy as plants in the same house not receiving such fertilizer. It thus becomes evident that the trouble lies in improper feeding of the plants.

Recommendations.—(1.) Avoid the use of too much manure or nitrogen-containing fertilizer, such as ammonia and sodium nitrate. (2.) Add acid phosphate or bone-flour, 3 oz. per plant, and potassium sulphate, ¼ oz. per plant, either before transplanting or just as the blooms appear. (3.) Avoid overwatering and then allowing to become too dry. (4.) Keep the plants growing evenly by keeping the temperature uniform and watering at frequent intervals, but not too much at a time. (5.) Do not allow the plants to dry out so as to check the growth. (6.) Do not attempt to force plants that have been checked.

It is necessary to understand what are the effects of sulphate of potash. That it steadies growth, makes growth firmer, and improves the quality of fruit is recognized. It is possible, however, by using an excess amount to stop growth altogether. The difficulty is to decide what is an excess. Quite evidently this is largely ruled by the amounts of other fertilizers applied, and the purpose of the potash. Thus, if a large amount of animal-manure or a nitrogenous fertilizer has been applied, and the potash is given to neutralize the nitrogen, then an excess amount might be not only safely used, but actually necessary; but no one could say what the actual amount should be. It is, however, quite obvious that both the nitrogen and the potash would largely represent wasted money, as one would be merely to nullify the injurious effects of the other, that ought not to have been used. In cases where an excess of nitrogen has not been used it will be different. In such cases an excess of potash might be positively harmful, having the effect of arresting growth. The amount per plant mentioned in the foregoing article—¼ oz. per plant—would, presuming plants to be set 18 in. by 3 ft. apart, amount to 151¼ lb. per acre. The largest amount I have ever seen advised is 2 cwt. per acre, and this is doubtless sufficient when the fertilizer is properly balanced, but certainly nearly double that would not do harm, though the additional amount might not pay.

The last issue of the *Journal of the Royal Horticultural Society*, England (Vol. 47, parts 2 and 3), contains a valuable article on "Tomato-diseases," by W. Bewley, D.Sc., Director of the Lea Valley Experimental and Research Station, Cheshunt, Hertfordshire. The following extract dealing with black-stripe will be of interest :—

"Stripe" disease is produced by *Bacillus lathyri* Manns and Taubenhaus, which is also responsible for "streak" of the sweet-pea and other leguminous plants. The organism is carried in the soil and water, and also in the leguminous weeds that surround so many nurseries. In the glasshouses it is readily spread from plant to plant by the workers engaged in pruning and tying, and it is highly probable that certain sucking-insects are instrumental in this way also.

Experiments conducted at Cheshunt have shown that there are considerable differences in the relative susceptibility of different varieties of tomatoes to this disease. The relation between manurial treatment and the incidence of the disease has also been studied, and it has been shown that increasing amounts of nitrogen without potash produced an increasing susceptibility to the disease, while increasing amounts of potash without nitrogen gave a corresponding increase in resistance to it. Where potash and nitrogen were used together there were indications that the potash counteracted the effect of the nitrogen. These results are fully confirmed by observations on commercial nurseries, where it has been found that plants growing rapidly and making large amounts of soft sappy growth are readily attacked by "stripe," while slow-growing harder plants are free from disease. Watering with sulphate-of-potash solution or dressing with the solid compound has almost invariably caused "striped" tomato-plants to grow away clean.

In view of the transmission of the disease from one plant to another by means of the pruning-knife, it is necessary to sterilize this instrument after pruning a diseased plant and before passing to a healthy one. This may conveniently be effected by wiping the blade of the knife with a rag soaked in 2 per cent. lysol or similar disinfectant.

COW-TESTING ASSOCIATION NOTES.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

In last month's *Journal* were given some general figures regarding the amount of herd-testing being done in New Zealand this season as compared with last. Complete statistics of all associations operating this season are being collected, but will not be available until later.

On going into the production of individual associations in the last few seasons it is gratifying to note in how many instances average-yield improvement has been effected. Following are butterfat figures gleaned from records compiled at the Dairy Division's headquarters :—

1919–20.	1920–21.	Increase for Season.	1921–22.	Increase for Season.
lb.	lb.	lb.	lb.	lb.
214·19	240·12	25·93	251·57	11·45
219·93	231·13	11·20	261·45	30·32
211·28	228·31	17·03	238·44	10·13
242·87	257·01	14·14	276·82	19·81
163·25	186·32	23·07	261·89	75·57
177·58	190·74	13·16	215·70	24·96
243·44	255·61	12·17	306·38	50·77
237·29	249·38	12·09	385·49	136·11

The fact of such marked increases as these obviously means that individual herds in many cases have been much improved. The following table records a few of the many interesting examples of this upward movement :—

Season 1920–21.			Season 1921–22.			Increase per Cow.
Number of Cows in Herd.	Average Days in Milk.	Average Yield of Butterfat.	Number of Cows in Herd.	Average Days in Milk.	Average Yield of Butterfat.	
		lb.			lb.	lb.
15	232	267·13	15	280	366·03	98·90
11	235	201·63	11	283	290·00	88·37
19	235	216·75	12	264	331·44	114·69
17	238	199·30	16	247	273·40	74·10
50	202	179·50	50	244	271·95	92·45
9	203	190·30	8	266	318·44	128·14
29	229	254·61	25	242	332·75	78·14
10	240	267·80	12	284	349·16	81·36
35	264	255·67	37	266	337·71	82·04
13	222	239·14	12	279	325·38	86·24
24	271	300·08	24	268	404·29	104·21
15	254	293·42	15	273	404·22	110·80
33	251	275·75	33	273	398·03	122·28
23	228	194·14	25	247	292·09	97·95
35	271	319·06	31	260	385·89	66·83
28	255	196·70	31	245	258·63	61·93

The foregoing figures clearly reveal the fact that New Zealand dairy-farmers who are testing their herds are working on sound

lines. The benefit derived is more than a personal one; it spreads from the herd-owner to the dairy company, and from the company to the whole country. If all dairymen would follow the example of the more progressive, it would not be many years before New Zealand might attain an average cow-yield second to none. The Department recognizes that the cow-testing association is one of the chief factors for economic success in the dairying branch of the agricultural industry.

(To be continued.)

HONEY AND ATMOSPHERIC MOISTURE.

R. WATERS, Biological Laboratory, Wellington.

FOR a long time past there has existed uncertainty as to what happens when honey is exposed to the atmosphere. In some countries it is reported that the honey parts with its moisture and therefore increases in specific gravity. The experience of New Zealand beekeepers in the handling of their honey has by no means been uniformly good—in fact, large quantities of honey are believed to have attracted moisture on exposure to the atmosphere, and thus to have suffered in quality through the lowering of the specific gravity.

The purpose of these notes is to set out briefly the results of a series of experiments, conducted by the writer, which aimed at securing some information as to the factors which determine whether honey will attract or part with moisture when exposed to the atmosphere. The following is a summary of the results:—

EXPOSURE OF HONEY TO ARTIFICIALLY CONTROLLED CONDITIONS IN THE LABORATORY.

1. Honeys of high specific gravity part with relatively little moisture in a dry atmosphere at 67° F. Thus, in five days eighteen hours a perfectly dry atmosphere increased the specific gravity of a 1·426 line of honey by only 0·002; in nineteen days it produced no further increase than this.

2. Honeys of low specific gravity part with relatively more moisture in a dry atmosphere at 67° F. Whereas in nineteen days a perfectly dry atmosphere increased the specific gravity of a 1·426 line of honey by only 0·002, yet in only six days twenty-three hours the specific gravity of a 1·403 line of honey was increased by 0·021. Thus, in a dry atmosphere the higher the specific gravity the more retentive is the honey of its moisture, while the lower the specific gravity the more freely does the honey part with its moisture. These two results merely confirm what one would naturally expect to be the case.

3. A dry atmosphere at 67° F. is not in itself very efficient in extracting excessive moisture from honey. Thus, a 1·384 line, even after twenty-one days' exposure to a continuously dry atmosphere at 67° F., increased in specific gravity to only 1·405—not high enough for export (that is, 1·420). Seeing that a high specific gravity causes

honey to hold its moisture more tenaciously than a low one, it would be naturally inferred that high specific gravity would likewise attract atmospheric moisture more strongly than low specific gravity. There seems to be some good evidence as to the relative attraction exerted towards atmospheric moisture by honey of high as against honey of low specific gravity. If, for instance, high specific gravity in honey exerted only the same degree of attraction to moisture as low specific gravity, then a line exposed to a saturated atmosphere for a long time, and consequently daily decreasing in specific gravity, should nevertheless daily attract the same amount of moisture. Therefore, on this assumption, if a 1·428 line in six days twenty-three hours decreased 0·023 in specific gravity, then in thrice the time it should decrease thrice the extent—that is, 0·069. This, however, is not found to be the case, for in twenty-three days it decreased only 0·055 in specific gravity. Another independent experiment also showed that the attraction exerted towards atmospheric moisture decreased with the specific gravity of the sample. In other words,—

4. Honeys of high specific gravity attract relatively more moisture from a saturated atmosphere in a given time, while—

5. Honeys of low specific gravity attract relatively less moisture from a saturated atmosphere in a given time.

6. The samples in this experiment attracted moisture from the saturated atmosphere much quicker than they parted with it in the dry atmosphere. Thus, a 1·426 sample decreased more in specific gravity (0·023) in six days eighteen hours at 81° F. than a 1·384 sample in a dry atmosphere at about 67° F. was able to increase (0·021) in twenty-one days.

EXPOSURE OF HONEY TO A NATURAL ATMOSPHERE CONTINUOUSLY NIGHT AND DAY.

In nature a constantly saturated or constantly dry atmosphere is not met with, therefore the foregoing does not directly foreshadow what would take place under natural atmospheric conditions. It does however, show something regarding the behaviour of honey under certain constant atmospheric conditions. The following deals with the effects of natural atmospheric conditions upon honey :—

1. Under certain natural conditions honeys exposed continuously night and day in the shade not only fail to increase in specific gravity, but actually attract water and so decrease in specific gravity. Further, the longer they are thus exposed the more water do they attract.

2. Honeys exposed to a constantly saturated atmosphere attract more moisture than when exposed to a natural atmosphere ; for a natural atmosphere only occasionally and for relatively short periods of time actually attains to saturation-point, even in the dampest month of the year.

3. Other conditions being equal, it may be safely assumed that the drier the atmosphere the less moisture will honey attract in a given time ; in fact, an atmosphere may be so dry that honey not only fails to attract any moisture, but actually yields up some to the atmosphere. The following lends some support to this conclusion : In a constantly saturated atmosphere at 81° F. a 1·426 honey sample decreased in specific gravity by 0·023 in six days eighteen hours, whereas

in a natural atmosphere ranging in relative humidity from 69 to 100 a 1·426 sample decreased by only 0·003 in nine days. Furthermore, in the relatively very dry atmosphere of the desiccator at about 67° F. a 1·426 honey sample actually increased in specific gravity by 0·002 in five days eighteen hours.

4. It follows, therefore, that in atmospheric humidity there is a point somewhere at which honey would neither lose nor gain water—a point at which the atmosphere and honey would attract moisture with equal force ; in such a state of equilibrium there would be no interchange of moisture. Conversely, it follows that if honey is left exposed to the atmosphere it will slowly make its way to this point of equilibrium with its surrounding atmosphere, and when it has reached this point it will then follow, though not keep pace with, the humidity fluctuations of the atmosphere. The higher the temperature the closer it will keep pace with the humidity of the atmosphere, for evaporation is quicker at high than at low temperatures.

EXPOSURE OF HONEY TO A NATURAL ATMOSPHERE DURING ONLY THE BEST DRYING-HOURS OF THE DAY.

The foregoing has shown the effects of exposing honey continuously night and day in the shade. As, however, the relative humidity commonly drops as the temperature rises during the hours of sunshine, exposed honey would therefore commonly collect more moisture during the period from the evening through the night till next morning than it would during the hours of light. The following conclusions relate to the exposure of honey only during the best drying-hours of the day—namely, during the hours of sunshine :—

1. Exposure in the shade : Honey of a specific gravity of 1·421 to 1·426 exposed with a large surface in the shade to an atmosphere with a relative humidity ranging from 70 to 90 hygrometric degrees and a temperature ranging from 50° to 60° F. will attract atmospheric moisture and decrease in specific gravity at the rate of 0·001 every two or three days. The rate of decrease in specific gravity will, of course, be slower the lower the specific gravity falls or the lower the initial specific gravity of the honey.

2. Exposure in the sun : Honey of a specific gravity of 1·414 or less, protected from the atmosphere when the sun is not shining, but exposed with a large surface in the radiant heat of the sun to an atmosphere with a relative humidity ranging from 70 to 90 hygrometric degrees and a temperature ranging from 60° to 80° F., will part with its moisture and increase in specific gravity at the rate of 0·001 every eight or nine hours. The rate of increase in specific gravity will, of course, be slower the higher the specific gravity becomes or the higher the initial specific gravity of the honey.

3. Under the same conditions of relative humidity (that is, 70° to 90°) exposed honey may be either damaged by attracting water or improved by parting with it, according to whether its temperature at the time is low or high. For at 50° to 60° F. a good honey decreased in specific gravity 0·001 in two or three days, whereas at 60° to 80° F. poor honey increased in specific gravity at the rate of 0·001 every eight or nine hours—in fact, eventually became high enough in specific gravity for export.

LIMING AND MANURIAL TRIALS WITH RAPE AT MARTINBOROUGH.

SECOND YEAR'S RESULTS.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Wellington.

IN the *Journal* for April last an account was published of liming and manurial experiments with rape, which were being conducted at Martinborough, in the Wairarapa district. The results of the first season's trials may be summarized briefly as follows: (1.) The local Martinborough lime on unmanured plots gave results 83 per cent. higher than those from plots which were neither limed nor manured. (2.) The average of all plots unmanured but limed was 75 per cent. higher than that of plots neither limed nor manured. (3.) The use of Mauriceville lime without manure increased the yield by 100 per cent.—that is, it doubled the return obtained from unlimed plots without manure. (4.) Ephos phosphate used with lime gave results 9·3 per cent. higher than those from Ephos without lime. Allowing 7 per cent. for margin of error, this still indicates that Ephos with lime, in the wet spring of last season, was, if anything, slightly more efficacious than Ephos alone. (5.) Gear superphosphate (which contains a small percentage of nitrogen in addition to water-soluble phosphate) gave 19·4 per cent. better results with lime than when used alone; or, again allowing 7 per cent. for experimental error, an increase of 12·4 per cent. (6.) Nauru ground-rock phosphate, used alone, showed results neither better nor worse than when used with lime. (7.) All limed and manured plots gave results from 90 to 100 per cent. better than those from plots untreated either with lime or manure. Among the manurial plots themselves there was little or no difference.

The experiment was continued this year with slight modifications in the manurial treatment. The limed plots remained as before, and no further lime was applied this year. The manurial trial plots, each 1 acre in area, were as follows: (1) Control (no manure); (2) 1 cwt. Nauru ground-rock phosphate with 1 cwt. Nauru superphosphate per acre (in lieu of Ephos used last season); (3 and 4) two consecutive acre plots, each treated with 2 cwt. Nauru ground rock per acre; (5 and 6) two consecutive plots, each treated with 2 cwt. Nauru superphosphate per acre; (7) 2 cwt. Gear rape-manure per acre.

This season rape and grass were sown in combination, the ultimate object of the experiment being to test the effect of liming and manuring on the establishment of ordinary permanent pasture on this class of soil. Towards the middle of December the rape crop, chiefly owing to the dry weather, showed signs of going off. Weighings were therefore taken on 18th and 19th December, so as to allow of the lambs being turned into the paddock.

The weather record for Martinborough shows that the months of October, November, and December, 1922, were comparatively dry. The rainfall and number of wet days for these months were: October, 0·98 in., 8 days; November, 1·20 in., 11 days; December, 1·22 in., 10 days. The total rainfall in 1922 was 24·53 in., with 157 wet days.

The results from the 49 plots comprised in this season's experiment, expressed in tons of rape per acre, are shown in the following table :—

Manure.	Control (no Lime).	3 Tons Martin-borough Lime.	2 Tons Mauriceville Lime.	Control (no Lime).	$1\frac{1}{2}$ Tons Martin-borough Lime.	1 Ton Mauriceville Lime.	Control (no Lime).
Control	3·21	4·50	5·46	4·17	5·78	6·42	4·50
Nauru rock and super . .	6·42	10·92	11·25	7·71	9·64	9·64	6·75
Nauru rock	6·10	10·28	10·92	6·42	7·71	8·03	7·07
Nauru rock	6·42	9·64	10·60	8·03	9·00	9·00	6·42
Super	6·42	10·92	11·25	7·71	9·64	9·64	6·75
Super	7·70	10·60	10·60	8·35	9·32	9·64	7·07
Gear rape	7·71	8·67	9·00	6·42	6·75	7·32	6·75

On the control plot, where no manurial treatment was employed, the average yield from unlimed plots was 3·96 tons, while that from limed plots was 5·79 tons—a difference of 1·83 tons, or 46 per cent., as compared with one of 75 per cent. last year. The average yield from plots treated with Martinborough lime was 5·14 tons, and that from those with Mauriceville lime 5·95 tons—a difference of 0·84 tons, or 16 per cent., as against one of 17 per cent. last year. It will therefore be seen that for the last two seasons the difference in the effects of the uncrushed Martinborough lime and the crushed Mauriceville product has been both slight and constant.

In the manured plots 1 cwt. Nauru ground rock mixed with 1 cwt. Nauru superphosphate on unlimed plots gave an average yield of 6·96 tons, while on limed plots the average was 9·77 tons, a difference of 2·81 tons, or 40 per cent. On the two 1-acre plots treated with Nauru ground rock the average yield for the limed portions was 9·06 tons, and for the unlimed 6·75 tons, a difference of 2·31 tons, or 34 per cent. Last season, as we have seen, no such difference showed itself, but as the soil in the whole paddock is sour, and has a somewhat impermeable subsoil consisting of an ironstone pan at a depth of 12 in. to 18 in., some such result might be expected, though hardly in so pronounced a fashion. However, the great benefit derived from lime is evident throughout the experiment. Superphosphate with lime gave 2·41 tons per acre, or $33\frac{1}{3}$ per cent. more than when used alone. The margin here is much wider than that shown last year. An increase of one-third in the weight of a crop should serve as an irrefutable argument in favour of the use of superphosphate after lime, rather than alone, on such soil in the Martinborough district. Where Gear rape-manure was used with lime the yield was at the rate of 7·76 tons per acre, while the manure used alone yielded at the rate of 6·96 tons, a difference of 0·8 tons, or 10 per cent. This still leaves a margin of 3 per cent. if 7 per cent. is allowed for experimental error. There is therefore here, as on the other manured plots, a slight indication in favour of the use of lime.

Comparing the manurial plots apart from liming considerations, both in actual and percentage yields (the control plot being represented by 100), the following results are obtained: Control (no manure), 4·88 tons per acre (100); Nauru ground rock with Nauru superphosphate, 8·37 tons (172); Nauru ground rock, 7·91 tons (162); Nauru superphosphate, 8·44 tons (173); Gear rape-manure, 7·36 tons (151).

TESTING OF PUREBRED DAIRY COWS.

JANUARY CERTIFICATE-OF-RECORD LIST.

THE following list, comprising the records of cows which received certificates during January, 1923, is supplied by the Director of the Dairy Division, Mr. W. M. Singleton:—

LIST OF RECORDS.

Name of Cow and Class.	Tested by	Age at starting Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
JERSEYS.							
Junior Two-year-old.		Yrs.	dys.	lb.		lb.	lb.
Perfection of Rosy Creek	Messrs. A. and J. O'Donnell, Hawera	2	66	247·1	365	11,394·8	658·64
Golden Sun Lass ..	Messrs. A. and J. O'Donnell, Hawera	2	74	247·9	365	11,514·0	640·78
Holly Oak's Annie ..	Sutton and Co., Masterton	2	50	245·5	365	10,921·2	586·06
Peaceful of Rosy Creek	Messrs. A. and J. O'Donnell, Hawera	2	58	246·3	365	10,811·7	575·35
Fair View Solid Gold	T. Linn, Mangatoki ..	2	19	242·4	365	8,022·0	472·09
Rosy Creek Daisy ..	C. P. Crowley, Kaponga	2	21	242·6	339	7,698·3	441·09
Uarda's Model ..	J. Penny, Mangatoki	1	338	240·5	346	7,052·95	434·41
Beechland's Sherry ..	Moreland and Son, Te Rapa	2	34	243·9	365	6,532·7	397·91
Silverhope's Nelly ..	J. Fulton, Whangarata	2	71	247·6	324	6,103·3	348·08
Russie	F. E. Day, Tamahere	2	37	244·2	365	6,355·3	326·51
Iva	F. E. Day, Tamahere	2	34	243·9	365	6,844·9	321·14
Nona	F. E. Day, Tamahere	2	11	241·6	365	6,476·1	314·63
Cowslip's Vixen ..	W. T. Williams, Pukehou	2	8	241·3	365	5,594·5	301·18
Vita's Beauty ..	F. E. Day, Tamahere	2	0	240·5	365	6,304·7	293·58
Senior Two-year-old.							
Joyful's Queenie ..	J. G. Robertson, Eltham	2	329	273·4	365	8,865·0	549·02
Heatherlea Maid ..	H. J. Lancaster, Levin	2	223	262·8	365	9,455·3	532·99
Howcroft's Luck ..	E. H. Linnell, Midhirst	2	120	252·5	330	6,148·2	321·54
Three-year-old.							
Rosy Creek Merry Lady	A. B. Robertson, Hawera	3	308	307·8	365	8,901·7	480·64
Waipiko Mabelle ..	C. G. C. Dermer, Cheltenham	3	4	277·4	365	8,979·5	442·08
Beechland's Violette	Moreland and Son, Te Rapa	3	343	311·3	363	8,733·9	378·85
Four-year-old.							
Beechland's Marguerite	Moreland and Son, Te Rapa	4	43	317·8	353	9,188·7	507·52
Frances	A. L. Dermer, Stanway	4	342	347·7	303	7,696·2	484·40
Gallantry	A. B. Robertson, Hawera	3	362	313·3	365	9,425·1	399·55
Mature.							
Springbank Sweet Joan	A. B. Robertson, Hawera	6	0	350·0	365	10,916·5	559·64
Fairy Queen's Hope ..	A. B. Robertson, Hawera	7	2	350·0	365	9,918·6	520·73
Keithdale's Treasure	J. Fulton, Whangarata	5	100	350·0	365	9,180·0	507·11

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
FRIESIANS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Bainfield Cowslip ..	W. D. Hunt, Invercargill	2 40	244·5	365	11,202·9	438·91
Ashlynn 49th ..	R. A. Wilson, Turakina	2 47	245·2	351	12,075·8	438·36
Pontiac Gretna Zena	R. A. Wilson, Turakina	1 335	240·5	339	11,064·6	404·56
Ashlynn 66th ..	R. A. Wilson, Turakina	1 334	240·5	364	9,741·9	376·75
Taumata Netherland Pietje Pontiac	Mrs. Budd, Wellington	1 328	240·5	325	11,729·45	345·38
Brookdale Rosella Pontiac	R. A. Wilson, Turakina	1 331	240·5	300	8,127·6	250·80
Senior Two-year-old.						
Ailsa of Friesland Park	A. S. Elworthy, Timaru	2 324	272·9	364	10,930·2	399·25
Foxbro Queen Pietertje	E. F. Walford, Aongatete	2 322	272·7	319	11,080·3	377·16
Junior Three-year-old.						
Kittie Maid of Maplehurst	R. A. Wilson, Turakina	3 14	278·4	365	18,580·7	574·48
Royal Johanna Pontiac	Bloomfield Farm Company, Wellington	3 15	278·5	365	12,641·9	414·60
Mature.						
Lakeside Rasel Queen	J. Stables, Riverlea ..	6 88	350·0	365	15,343·7	620·12
Lady Paul Pietertje..	R. Melvin, jun., Masterton	5 357	350·0	365	14,955·5	607·98
Sir de Kol Mentor Lass	R. J. Potter, Pukerau	7 363	350·0	365	15,191·1	583·38
Dominion Canary Duchess	T. A. Stephens, West Plains	6 356	350·0	362	13,984·0	501·08
Monavale Evergreen Paxton	S. Clements, Hamilton	5 51	350·0	310	12,861·3	471·95
MILKING SHORTHORNS.						
Mature.						
Sandy 3rd of Cornwall Park	J. Pease, Matatoki ..	10 295	350·0	365	11,288·5	473·26
AYRSHIRES.						
Two-year-old.						
Bright Smile 4th of Greenbank	W. Moore, Masterton	2 21	242·6	365	13,799·0	519·62

Second-class Certificates.

JERSEYS.						
Glenmore Girlie ..	A. C. Lovelock, Woodville	1 284	240·5	365	6,406·1	392·44
Eringa Joyce ..	A. Keith, Masterton ..	1 346	240·5	365	7,580·2	371·97
Roslyn Gay Bon* ..	J. Harris, Bombay ..	1 271	240·5	349	5,645·3	293·14
SHORTHORNS.						
Sunnyside Bonnie Jean 8th	Sunnyside Mental Hospital, Christchurch	5 310	350·0	360	12,796·9	487·23

* Published incorrectly in November, 1922, *Journal* as a first-class certificate.

SEASONAL NOTES.

THE FARM.

FIELD CROPS AND PASTURES.

Early Autumn Ploughing.

STUBBLE and land that has grown early soft turnips should be ploughed as soon as possible. If the land is required early next spring it will be good policy in many districts to put it into a catch-crop for feeding-off, as, apart from the food furnished, the weeds are thus controlled and the fertility of the land built up. On the other hand, where winter fallowing is commonly practised or desired for any special reason, the longer the ground is turned up to the weather the better heart will it be in during the following season. The value of a winter fallow, especially where the climatic conditions are fairly hard, is very great, allowing, as it does, for the mellowing action of frosts and rain, and assisting in the complete decay of stubble and weeds left from the preceding season's crops.

Winter and Spring Forage Crops.

The sowing of forage crops for winter and spring feed should be continued in March. If the crop is to be cut and fed out in the early spring Green's Ruakura or one of the white oats, such as Garton's, will give the heaviest weight of material. If, on the other hand, the crop is to be fed down several times and then let go for a hay or grain crop Algerian oats or Algerian oats and tares are better. If oats alone, a sowing at the rate of 2½ to 3 bushels per acre may be made, and when tares are included sow 2 bushels of oats and 1 of tares. Peas are sometimes substituted for tares, but, as a rule, they do not stand the winter and early spring feeding. Any good phosphatic manure, at the rate of 2 cwt. per acre—say, half super and half Nauru—will be found suitable.

Pasture-establishment.

The sowing of pastures, both temporary and permanent, should be pushed along, so as to give the clovers a chance of establishing before the cold weather sets in. In cases where rape has been fed off early, and is not good enough to keep for a second feeding, grass may be sown to advantage. Every care should be exercised in the cultural operations. Owing to the fact that the grass crop is the most common one grown it has been comparatively neglected in this respect. A fine, well-packed tilth, with moisture near the surface, is the ideal. If no roller is available consolidation may be obtained by driving a flock of sheep backwards and forwards over the field. For average soils and conditions a good permanent mixture is somewhat as follows: Cocksfoot, 14 lb.; perennial rye-grass, 16 lb.; timothy, 4 lb.; crested dogstail, 2 lb.; red clover, 4 lb.; white clover, 2 lb., per acre.

In the Auckland Provincial District considerable areas of ploughable land are being brought in each year from the virgin state, and sown down to grass for the first time after a root crop. Such land may be roughly classified into two types — light and heavy. Much of the light country is of volcanic origin and responds remarkably to top-dressing. Generally the light country, if reasonably level, will hold rye-grass fairly well, if regularly top-dressed with phosphatic fertilizers. The heavier soils, especially the gum-land soils of the better type, dry badly in the autumn, and perennial rye-grass quickly disappears. Cocksfoot, crested dogstail, and timothy hold fairly well, and for average conditions—south of Auckland City — when sowing a pasture for the first time, and the land is intended for dairying, a mixture of somewhat the following composition should be used: Italian rye-grass, 4 lb.; cocksfoot, 15 lb.; crested dogstail, 4 lb.; perennial rye-grass, 8 lb.; Poa pratensis, 1 lb.; timothy,

2 lb.; white clover, 2 lb.; red clover, 2 lb.; Lotus hispidus, 1 lb., per acre. Such a mixture will hold fairly well on the better-class heavy land, and the necessary spring feed can be provided by temporary pastures of Italian rye-grass and red clover sown in February or March.

Mowing and Harrowing of Pastures.

After wet seasons like the present one pastures which have been carrying dairy stock throughout the summer will often have a patchy, rough growth, and a good plan, where conditions permit, is to put the mower over them. Dry or store cattle will readily eat the cut stuff, and the tripod or chain harrows can then be used to the greatest advantage. If this is done during March, and the field closed for a few weeks, fresh growth will be provided for later use. This method utilizes rough feed that would otherwise be wasted and trodden down, and prevents the smothering-out of many grasses. The harrows should break up and spread all animal-manure that has been dropped during the summer months. The manure being evenly spread gives the maximum results, encouraging growth before the cold weather sets in. Grass and clover seeds that have fallen will germinate more freely when given light and air, and better growth of seedlings is promoted. In this way the pasture becomes renovated at comparatively small cost.

Top-dressing and Liming.

Top-dressing of pastures in March is fairly common in districts where winter milking is practised. By top-dressing early with a quick-acting phosphatic fertilizer a good autumn growth of grass is obtained, which considerably lessens the need for supplementary winter feeding with roots, provided a reasonable provision of hay has been made.

In many localities the land will later on become too wet for carting, and where such is the case those paddocks requiring liming should be treated in good time. The question of the use of burnt lime or carbonate of lime (crushed limestone) is largely governed by the factor of available supply. In south Otago and Southland, where liming is so essential, a dressing of 1 ton of burnt lime per acre is a good standard.

Lucerne.

Young stands of lucerne, sown earlier this season, will in most cases have been cut once, and will be ready for cutting again about the end of March. As soon as this second cut has been removed the land may with advantage be given a good harrowing with the tine harrows or light cultivator. This should be sufficiently severe to destroy most of the weeds and thoroughly loosen the surface of the land, thus causing a vigorous growth of lucerne. A good working at this period will generally save a great deal of trouble in subsequent years.

March is also a good month for renovating lucerne-fields that have been neglected, as usually the weather is dry enough to destroy the grass and weeds that are cultivated out. If there is much grass the disk harrow can be used to cut it up, but the disks must be run as straight as possible. After disking, the sods may be thoroughly broken up by means of the tine harrows and cultivator. Where the stand is old and thin and nearing the end of its life it is good practice to sow a few pounds of Italian rye-grass or a bushel or two of oats after this cultivation. The rye-grass or oats will provide good early feeding and occupy the land, which otherwise may grow weeds or useless grasses.

Established stands of lucerne may be grazed from now on till the end of the growing season. Young stands will be better not grazed at all during the first year.

Where it is considered that a lucerne-stand requires lime this is best applied in autumn.

Irrigation Farming.

In Central Otago settlers practising irrigation must make provision to carry out the final watering of their land in March, as the supply of water from the races will be cut off at the end of the month. This especially applies to the soaking with water of uncultivated ground intended to be broken up during the winter. There is no doubt that by this means ploughing is made easier and more satisfactory. A start should be made to break up new land, and this operation not left until later on in the winter, when, in all probability, the ground will be frozen so hard that ploughing will prove out of the question.

The Hay Crop.

Although it has been an excellent season for pastures, the hay crop suffered badly from the wet weather, and much of the hay that was saved was got in in bad condition. A wet season upsets the ordinary method of saving hay, but if extra help had been available much of the hay could have been got in in better condition. In Scotland, where the farmers are used to wet weather at haymaking, they cure the hay in very large cocks well and carefully built to turn the rain. Hay can be cocked in this way when still fairly green, and will cure and dry in the cock without heating. To turn the rain a cock must be carefully built up from the bottom like a small stack; it is useless to expect one run together with hay-sweeps to turn any water.

—*Agricultural Instruction Service.*

THE ORCHARD.

HARVESTING, GRADING, AND STORING.

The orchard harvest is at its height during the month of March, leading varieties of apples—Dunn's, Jonathans, London Pippin, and Delicious—and most varieties of pears being then gathered. The flavour of pears is often depreciated through the fruit being left too long on the tree; the juice and aroma are usually best developed by picking as soon as maturity is reached and affording proper storage. Fruit receiving such treatment travels well and with little loss.

Second-grade fruit requires the careful attention of the orchardist; there is a common tendency for cull fruit to be allowed to get into this class. A fruit-grader must not merely grade out the " fancy " fruit, but he must also see that the second grade is kept clear of culls. The market in the past has suffered badly from mixed and low-grade fruit. Packing fruit true to grade is sound business, and the main factor in successful marketing.

The fruit-store will again be in demand, and, before recharging, a good clean-up will be required. A knowledge of fungus, bacterial, and insect life, even if only an elementary one, makes one realize the need for cleanliness in a fruit-store. Fumigation, spraying, or washing are different ways of dealing with the problem. Apples and pears can be stored in boxes stacked in tiers of six or seven, and raised high enough off the ground to permit a good draught beneath. To build the stacks true one must start with a level foundation. Each variety, separated into its respective sizes, should be kept together, and a passage left sufficiently wide and straight to operate the store. For the first few weeks considerable moisture is given off, and ample ventilation—indeed, a draught—is required to carry it away.

GENERAL.

A common oversight at this period is the neglect to spray the late pip-fruit crop until an inspection reveals the fact that late infections of black-spot and leaf-roller have caused rather serious damage. The former is apt to recur during the cooler moist days of autumn, while every owner of fruit for storage has a wholesome dread of the attacks of the leaf-roller caterpillar. Spraying with lime-sulphur and arsenate of lead should therefore be carried out to prevent such trouble.

Where cover-crops are needed, peas, oats and vetches, or oats and horse-beans may still be sown. The application of 2 cwt. or 3 cwt. of manure per acre at the same time is usually an advantage.

Autumn winds are apt to damage grafts made in early spring. These should be looked over, and those likely to be blown out made secure.

—*W. C. Hyde, Orchard Instructor, Nelson.*

CITRUS FRUITS.

Contrary to expectations at this season of the year the weather conditions have remained wet, and although this has been beneficial to citrus-growers as regards inducing growth, it has also been conducive to the rapid spread of brown-rot. This particular disease thrives under humid conditions, and, as there is every appearance of the continuation of moist weather, orchardists are advised to pay particular attention to the immediate removal of any affected fruits, destroying them by burning. Afterwards the trees upon which the disease has been noticed should

receive a dressing of from 2 lb. to 3 lb. of pulverized sulphate of iron per full-bearing tree, applied to the ground directly beneath the spread of the branches and lightly forked in. This will assist in the control of the disease, but the application of bordeaux, 4–4–40, as advised in last month's notes, should be continued monthly under such conditions, for the control not only of this disease, but of other fungoid diseases attacking the trees.

Cultivation should receive as much attention as is possible at this busy season of the year. It has been noticed that in many cases citrus orchards have suffered from the exceptional frosts experienced during last winter, and that insufficient care has been paid to the removal of frosted parts. These should be removed immediately without fail.

FIREBLIGHT.

Further tip-infection on apples may be looked for from time to time during this month. The treatment recommended for this is the same as previously—immediate removal and destruction by burning, and painting over of the wounds as already advised.

Commercial growers generally are making a splendid fight in the control of this disease. Vigilance should be maintained if the disease is to be kept under reasonable control. Failure to effectively deal with fireblight immediately it has appeared in the orchard may mean the loss of entire trees, and, indeed, entire orchards.

—*J. W. Collard, Orchard Instructor, Auckland.*

DISPLAY OF NEW ZEALAND FRUIT MADE DURING LAST EXPORT SEASON IN STREET WINDOW AT THE HIGH COMMISSIONER'S OFFICE, STRAND, LONDON.

POULTRY-KEEPING.

FURTHER POINTS IN CULLING.

Last month the matter of culling unprofitable hens was touched upon, March being mentioned as the best time of year for the purpose; some advice was also given in regard to the carrying-out of this important work. The necessity of acting upon the advice given and weeding out every bird that has passed its best period of production is again urged. Of late the average poultry-keeper, owing to the high price charged for foodstuffs and the low price received for eggs, is having a hard task to make both ends meet. The best way to meet this position is by retaining in the flock only birds that are paying their way, or that are likely to do so in the near future. The food bill will thus be reduced, and there will be a saving of labour, this result, generally speaking, being obtained without any appreciable reduction in the number of eggs produced.

The reason for stating that March is the best time to cull a flock of hens is that at this period of the year, or, in other words, towards the termination of the laying season, certain signs manifest themselves in individual birds as indicative of laying-capacity. These signs are not only a guide as to whether a bird is in a laying-condition or not, but they also indicate to a high degree whether it has produced heavily during the past laying season, and, further, whether or not it is likely to prove a good layer during the following season. Some persons are specially gifted in having a natural eye for form, and are thereby able to quickly observe the change that takes place in the appearance of individual birds. This faculty of discriminating between the good and the poor hen, however, is one which may easily be developed by observation and study, and, better still, by first being given a practical demonstration by a person of experience. Once this qualification is acquired, its value to the poultry-keeper cannot be overestimated. It enables him not only to eliminate poor producers from his flock, but also to select for future breeding purposes the birds best suited for the maintenance of a high-standard laying-flock.

In order to assist the novice in the work of culling, some of the chief points to be observed are here enumerated, but, naturally, to apply them in a proper manner requires practice. These guides can be made use of only previous to the time of moulting, as no one character of a bird can be judged with any degree of accuracy once the moulting process has begun. There should therefore be no delay in the carrying-out of a thorough culling campaign.

In the first place, the time of moulting gives a good guide to laying-capacity. It is the long-season layer, or, in other words, the bird that lays well in other than the natural laying season, that is desired and is the most profitable to keep. To do this a bird must necessarily be a late moulter, as the laying season usually ends when the moulting-period begins. Therefore the birds that show evidence of being early moulters should be culled out, and the late moulters retained for laying and breeding purposes. It must be remembered that this test only applies where the birds have been hatched at about the same time, and have been fed and managed under similar local conditions. As an instance, where first- and second-season birds are running together it will usually be found that the former will moult first, so that some allowance must be made for this. Especially is this the case where the older birds have been selected as late moulters the previous season. No rule is capable of universal application, however, and exceptions must be allowed for.

In addition to being a late moulter the good layer will usually bear a shabby appearance at this period of the year. For this reason alone such birds are often discarded by the novice. In the case of white varieties the plumage, although tight and dense, becomes more or less straw-coloured. This is especially so where the birds have free range or where good-sized runs are provided. The head also becomes more or less devoid of feathers. This, with a clean face and bold prominent eyes, is an undoubted sign of strong constitutional vigour. The legs will appear more or less white and decidedly flat, although they may have been very yellow and more or less round during the pullet stage. The fact of the legs becoming more flat and the colour leaving them is no doubt due to the yellow fat being drawn from them to supply the egg-yolk with its yellow pigment. Obviously, the greater the layer the greater will be the tax on the fat-content of the legs, and consequently the more flat and bleached the legs will become.

What applies in the case of the legs does so in like degree to the body-skin, particularly about the vent, and also to the beak. It may be mentioned that hens running on a grass range do not usually bleach out in the legs to the same degree as those kept in confinement. Here again local conditions must be taken into account in applying the test.

The body of the good layer is usually deep. A well-developed crop and abdomen are imperative, as the bird must have large capacity for food and the digestive power to convert this to the manufacture of eggs, and for the maintenance of the strong bodily vigour which is demanded in the high-type laying-bird. The skin of the abdomen should be soft and flexible to the touch, so as to allow for contraction and expansion in accordance with the bird's laying-condition. Beware of the bird that is hard and coarse to the touch around the abdominal region ; this indicates that it is converting its food to fat and flesh instead of, as in the case of the good layer, into eggs.

This point also applies in the case of birds above the normal weight of their breed. Such birds may exhibit a well-groomed, healthy appearance, but nevertheless in the majority of cases they do not pay to keep. On the other hand, the good layer at this period of the year will be found in a lean condition, and, as already indicated, generally presents a worn-out, unkempt, rough-and-ready appearance. The reason for this is obvious : it could not be expected to lay on fat while producing a maximum egg-yield.

Summarizing the foregoing points, the birds that should be culled are those that show signs of early moulting ; those with a well-kept plumage, and which are above the normal weight of their breed ; those with hard development in the abdominal region ; and those with points indicating a weak constitution, such as dull sunken eyes, heavy well-feathered eyebrows, bright-yellow legs, loose feathering, and sluggish appearance.

Some poultry-keepers practically refrain from culling their hens until they have passed their second season of production, but this is a mistake. Drastic culling should take place after the pullet's first laying season. Indeed, poultry-keepers would be well advised to cull out all undersized, weak-constitutioned pullets even before they commence to lay. Usually such stock not only produce small eggs, but are also susceptible to every passing ailment. In any flock few birds which have passed their second season of production will really pay to keep for another year, and it is only the person with the trained eye who is able to distinguish these. Culling unprofitable stock is one of the essentials in successful poultry-keeping, and yet there are probably thousands of people who keep their birds almost until they die of old age. In these circumstances it is of little wonder that the question as to whether or not poultry-keeping pays is so often debated.

SELECTION OF BREEDING-HENS.

Because the drone types have been eliminated from the flock and only useful birds remain on the plant it is not to be taken for granted that all of the latter are suitable for the breeding-pen. A bird may show abundant evidence of possessing productive power, but something more is required. If everything is sacrificed to egg-yield, the other important points in the make-up of a good breeding-specimen will suffer as a consequence. Combined with the desired constitutional points and features suggestive of laying-capacity, due consideration must be given to breed-characteristics. Intending breeders should not be misled by the foolish advice, so often given by inexperienced persons, that the best layer is necessarily the best breeder. If a uniform, heavy-producing flock is to be bred and maintained, an ideal type, in addition to productive capacity, must be aimed for. In this connection the novice who is really anxious to build up a high-standard flock of layers is well advised to secure a copy of the "New Zealand Utility-poultry Standards," obtainable from the Department at a cost of 3s., postage free. This contains plates of the types aimed at in the popular breeds of poultry, together with weight clauses and general standard requirements.

Another important point is to avoid for the breeding-pen undersized specimens of their breed, even though such birds have proved themselves good layers. They may succeed in an egg-laying test, or even break records, but it is seldom or never that they produce desirable progeny. It is always a good plan to choose for the breeding-pen a hen slightly larger than that desired in a laying-flock. Always remember that, as in the case of other classes of live-stock, the small birds will come readily enough without specially breeding for them. On the other hand, oversized specimens should certainly be guarded against.

After selecting the best specimens for future breeding purposes, these should be carefully marked and placed by themselves, preferably on a free range. This will enable them to recoup after their exhausting laying season, and they will thus be in a healthy vigorous condition when the breeding season comes round.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FINAL EXTRACTING OPERATIONS.

THE honey season up to the time of writing has been very disappointing. The bees throughout have been in excellent condition and the pastures all that could be desired, but the weather conditions have not been in favour of the apiarist. Most of the time it has been too cold and showery either for clover to secrete nectar or for bees to fly freely. There is just a possibility that weather conditions may yet improve in time for the bees to add considerably to their present stores, but this is most unlikely. The honey-flow, as a rule, closes about the middle of February, and very rarely continues into March. Beekeepers generally will no doubt have done most of their extracting before the end of February, as it is generally recognized that this work should be attended to as far as possible before robbing starts.

The bees are very difficult to handle to any extent immediately after the close of the honey-flow, and, in consequence of this, outdoor feeding is sometimes resorted to to bring about conditions approaching as nearly as possible those of a natural flow. Some American beekeepers recommend feeding a syrup consisting of 1 part sugar to 9 parts of water for this purpose. As a temporary expedient to tide the beekeeper over a very trying period this may occasionally be practised, but it cannot be recommended as a general practice. A simpler and better plan for dealing with robbers while taking off honey for extracting is to put out a few supers of wet combs—combs from which the honey has been extracted. These supers should be placed on a bottom-board and covered with a roof, giving the bees just the ordinary hive-entrance as a means of access to the combs.

But although this answers admirably as a means of attracting robbers while more honey is being taken off for extracting, it cannot be recommended as a means of getting the extracted combs cleaned up. The bees do not mend any broken combs under such circumstances. There is no better plan for the latter purpose than to put the supers of empty comb back on the hives. The bees may store the honey in a few of the centre combs, but they can be induced to remove this by taking out the combs that have been cleaned up and spacing the remainder some distance apart, and, for preference, so placing a mat under the combs that a small space is left at the end for the bees to come up. The Deadman super-cleaner is an excellent contrivance for getting the bees to clean up the combs after extraction. It is simply a large bottom-board capable of holding one or more stacks of supers in addition to a colony of bees. Means of access for the colony of bees are provided by cutting the slats on which the supers rest.

It is to be deplored that some beekeepers put the cappings outside for the bees to clean up. While there may be no objection to such a practice in districts quite free from foul-brood, it should on no account be resorted to when there is any possibility of this disease existing.

TREATMENT OF FOUL-BROOD.

It is now too late to adopt the treatment known as the McEvoy system, and yet it is advisable to do as much as possible to reduce the risk of infection spreading during the winter or spring months through the robbing of infected colonies. With this object in view there should be set aside as many combs of fully-capped honey as may be necessary, these being taken from colonies known to be free from disease. When brood-rearing has practically ceased all the bees of the infected colony should be shaken into a clean, empty hive, and left until on the point of starvation. A few of the reserve combs of sealed honey may then be given, and the hive filled up with empty combs.

A safer plan, still, would be to remove the queen (if valued) from the infected colony immediately, and form a three- or four-frame nucleus colony with her,

taking the bees and brood required from one or more clean colonies. The infected colony must then be destroyed. Apiarists should make a point of adopting one of these two courses if foul-brood is present, and should not take the risk of infection spreading during the winter or spring.

PACKING HONEY FOR EXPORT.

Beekeepers are reminded that it is now necessary to pack honey intended for export in new tins that have not been used for any other purpose. The use of benzine-tins was allowed for a short time during the war period, but this concession has been withdrawn. The tins should contain exactly 56 lb. or 60 lb. net, and should be packed in cases 19½ in. by 9¾ in. by 14 in. The ends of the cases should be of ⅞ in., and the sides, tops, and bottoms of not less than ½ in. dressed timber. As most beekeepers packing honey for export ship through the New Zealand Co-operative Honey Producers' Association, they will obtain further information from that company. Independent shippers may obtain copies of the export regulations and any other particulars in this regard on application to the Department.

—*H. W. Gilling, Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

Tomatoes: Irish blight is causing losses in a number of places. This disease, however, can be almost entirely avoided by planting in an open situation on well-drained soil, by avoiding the use of manures or fertilizers that cause over-luxuriant growth, and by consistent spraying before the disease appears. A bad attack of leaf-spot in a number of glasshouses has come under my notice. The houses are 40 ft. wide and 150 ft. long, the plants being arranged in rows 2 ft. apart and 1 ft. apart in the rows. At the time of writing the plants are over 6 ft. high. In this crowded state it is quite impossible for air to pass freely through the foliage, and as a consequence the atmosphere is kept in a humid and unwholesome state. Further, none of the old or diseased leaves have been removed, so that the disease has spread till scarcely a sound leaf remains. The plants should have been a third less in number, which would have secured a better circulation of air. The old leaves should have been cut off as soon as the fruit below them was gathered, thus securing drier conditions on the soil-surface, which would beneficially affect the whole of the house. These measures, together with spraying—impossible in such a crowded house—would have prevented the disease assuming the proportions of an epidemic. The smaller number of plants could have been properly attended with the same amount of labour as expended on the larger number, and with far better results.

An early kind of cabbage, such as Flower of the Spring, should be sown at once to provide heads from towards the end of September. Lettuce-seed for the earliest crop should also be sown.

Cabbages, brussels sprouts, broccoli, and cauliflowers for cutting about Easter-time should have been planted in December and January, and should by now be growing freely. If they have not made a satisfactory start give a dressing of nitrate of soda—about ½ oz. per square yard—repeating the application about four or five weeks later. If immediate results are desired apply the nitrate in a liquid form, 1 oz. in 3 gallons of water being sufficient for about twenty plants. The surface soil should be kept loose and free from weeds by shallow hoeing, or with a Planet Jr. cultivator. If the soil has not been supplied with fertilizer this can be applied before cultivating. Blood-and-bone is suitable, applied at the rate of 2 oz. to 4 oz. per square yard according to the quality of the soil.

Spinach is one of the most valuable winter vegetables, and is not subject to any special pest; it can therefore be regarded as a sure crop. Sow at once in drills 12 in. to 15 in. apart, and thin the plants to 8 in. or 10 in. apart in the drills. For commercial crops thinning is not done, as the plants are pulled out by the root and tied in bundles. In private gardens only the leaves are gathered, and the larger these are the better they are in quality.

Turnips for winter use should be sown about the middle of March. Sow two kinds—Snowball for first use, and a yellow-fleshed variety to stand longer. These latter are not well flavoured during warm weather, but when the weather becomes cold they are decidedly superior to the white-fleshed sorts.

Onions will be near ripening. Keep the soil clean by shallow cultivation. Do nothing in the way of feeding or watering at this stage; a clean, open soil-surface will give them all the assistance that it is safe to give. Breaking down the tops may be advisable at times, especially if wet weather occurs, but it is seldom necessary, and is best avoided. Care must be taken not to rupture the stem in doing it, or a new top will grow up through the break and ruin the bulb.

Pumpkins and marrows that are to be kept for winter use should be cut as soon as the rind becomes so hard as to be difficult to pierce with a thumb-nail. At this stage the flesh has not become thinned to a great extent, nor has the rind fully hardened. Provided they are not knocked about, these gourds will keep through winter. A good storage place is under trees that will throw off most of the rain and protect them from frost, but they are safer under cover in a building.

—*W. H. Taylor, Horticulturist.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LAMBS ON RAPE.

A. DAVESON, Albury :—

I would be obliged if you could inform me regarding the dying of lambs on rape. It is customary in these parts to lose quite a number of lambs when on this crop. Experience has shown that when rape is sown with grass the death-rate is very low, but when grown alone the deaths are very frequent. Probably you could recommend something to replace the grassing-down. How would oats do?

The Live-stock Division :—

The greatest care should be exercised when first feeding lambs on rape, as it readily causes bloating. Lambs, therefore, should only be allowed on rape for short periods until they become accustomed to it, and they should never be put on it when they are very hungry or when the weather is wet. When sowing rape it is advisable to occasionally miss the width of a drill, and about three weeks later to sow that portion with mustard, which tends to counteract the action of the rape when feeding. Oats sown with rape would have no counteracting effect.

CALIFORNIAN THISTLE IN HAY.

J. C. C., Taupiri :—

In my hay paddock I have a clump of Californian thistle about 2 acres in extent bounding the creek, there being not a sign of thistle on any other part of my farm. Each year the thistles are mown and burned. This year they form a portion of my hay crop, and among them is an abundance of clover. I made a separate stack on this 2-acre patch. The thistles were cut and put in the stack while they were flowering, none having seeded. Is it advisable to feed this stack to stock if it is fed out in the vicinity of the stack? Will thistles seed in the stack? Will stock carry the seed to other parts; and, if so, will the seed germinate? Is there any method of complete eradication?

The Agricultural Instruction Service :—

The question of whether the thistle is likely to spread from feeding out the hay depends on the condition of the seed-heads. It sometimes happens that all the flowers on a patch may be either male or female, in which case naturally no seed forms, and the patch only extends by means of its underground stems. To eradicate the thistle is difficult, but the following method is successful if thoroughly carried out. This autumn you should mark out the limits of the patch. Next spring, before the thistle starts to grow, plough the patch and work it down to

a fine tilth. Then plough the land every ten to fourteen days during the summer. This prevents the stems ever reaching the light, and exhausts the food-reserves in the underground stems. Ploughing the area during the summer is the only method to adopt, as it cuts off the stems before reaching the light; surface cultivation will not do this.

CALVES WITH HUSK OR HOOSE.

"CALVES," Turakina :—

I have half a dozen Jersey-cross calves, one to three months old, affected as follows: They cough when moved, and also at rest, and especially after feeding. Some have quickened breathing and panting with the mouth open. One died frothing at the mouth and gasping for breath, the ribs moving as well as the flanks. The calves sleep at night in an open shed with an earth floor, which they mess up very much in wet weather. They are grazing on high, dry land with good clover and grass. Could you inform me as to treatment?

The Live-stock Division :—

Your calves are evidently suffering from an attack of husk or hoose, caused by the presence of the *Strongylus filaria* worm. The floor of the open shed in which the calves lie at night must be dug up and thoroughly dressed with quicklime, and the walls limewashed. Each calf should receive the following drench, carefully administered: One teaspoonful turpentine and four tablespoonfuls milk, this being well shaken before it is given. If the calf attempts to cough, its head should be released or it may choke. Repeat the drench in two or three days. An immediate change of pasture should be made.

INTERPOLLINATION OF APPLE-TREES.

W. W., Redvale :—

Will you kindly inform me which variety of apple is necessary to cross-fertilize the Delicious? We have forty Delicious apple-trees planted in a gully with one hundred Gravensteins, and, though the former (nine-year-old trees) are covered with blossom in the spring, we get only about a dozen apples from the lot, so it appears that the blossoms do not get fertilized.

The Horticulture Division :—

The opinion of investigators is that one variety is as good as another for interpollination purposes, provided the blossoms are open at the same time. Gravenstein flowers with Delicious, so should answer as a pollinator for Delicious. Other popular varieties that flower with Delicious are Jonathan, Golden Pippin, Dunn's, and Commerce. It may be stated that the Delicious is rather erratic in bearing, failing at times to produce a full crop when circumstances appear favourable.

WARTS ON DAIRY CATTLE.

G. H. NEILL, Tutekehua :—

I have a cow with warts all over her udder and teats. Can this condition be cured? I have also a Jersey bull, two years old, and warts are appearing round his eyes and nose and on the back of his legs where the calves suck. What treatment should be given in this case?

The Live-stock Division :—

We should advise, with reference to the cow with warts on her teats, that these be removed in the off season, when the animal is dry. They should then be clipped off with a pair of surgical scissors. After removal, any blood that remains on the parts should be washed off, and a little tincture of iodine applied. In the case of the bull, the warts should be cleansed, and a little powdered bluestone applied daily. If this has not the desired effect they will have to be surgically removed. When applying the bluestone care should be taken to see that it does not get into the animal's eyes. He should also be separated from the calves.

SHEEP WITH SORES ON NOSE AND MOUTH.

"X. Y. Z.," Taumarunui :—

Last summer quite a number of my lambs and some sheep suffered with sores or scabs on the nose and mouth, which had a serious effect on their condition. Some of my neighbours say it is a form of eczema. Could you tell me the cause and a cure, if any ?

The Live-stock Division :—

Lambs and sheep are seen to be affected as you describe when running in rough pastures or among thistles, &c., which set up irritation and sores around the nose and lips. All that is required in such cases is a change on to shorter feed, and a little zinc ointment smeared on the sores.

BROKEN GLASS FOR POULTRY GRIT.

"INQUIRER," Kurow :—

Is broken glass suitable as grit for poultry ?

The Chief Poultry Instructor :—

We do not favour broken glass as grit for poultry, chiefly for the reason that it is soon passed from a bird and eaten by others, which in itself would act as a ready means of spreading such a disease as tuberculosis should a bird happen to be affected. Furthermore, the sharp pieces of glass voided are apt to stick in the birds' feet and cause abscesses, corns, &c. As grit we recommend sharp crushed gravel, and as an egg-shell-forming material crushed oyster or other sea shell.

HORSES AND TUTU.

M. ADAMS, Silverstream :—

Would you be kind enough to tell me if there is any danger in allowing horses to graze in a field where tutu is growing ?

The Live-stock Division :—

There are no cases on record of horses being poisoned by tutu. Under present conditions, with plenty of grass available, a horse is not likely to attempt to eat it.

FEEDING OF MOTHERLESS FOAL.

J. A. SCARFF, Geraldine :—

I would be pleased if you would let me know the best food to give a foal which is now a little over a month old, the mare having died a few days ago. I am now feeding the foal on new cow's milk.

The Live-stock Division :—

If the foal is being fed from a pail it will be a simple matter to get the foal to take a little crushed oats and bran. All that is necessary is to put into the bottom of the pail a handful of crushed oats and bran after the foal has finished drinking the milk. In a day or two the foal will commence to nibble the oats and bran. If, however, it has been fed from a bottle there will be some difficulty in getting the foal to eat. You should get a small box containing a handful of bran and crushed oats, over which a wisp of sweet hay is suspended by cord or twine. The foal will nibble the hay, and after a few days or so will find the oats and bran. Under no consideration mix the oats and bran with the milk. If this is done the oats and bran are bolted with the milk, digestion is impaired, and diarrhoea and irritation of the stomach and bowels ensue. Once the foal commences to clean up the oats and bran he should be fed with this three times daily, the quantity given at each feed being gradually increased as the foal grows older.

OCCUPATION AND USE OF LAND IN NEW ZEALAND: 1920-21 AND 1921-22.

—	1920–21.	1921–22.	Increase	Decrease.
	Acres.	Acres.	Acres.	Acres.
Grain and pulse crops	883,129	954,094	70,965	..
Grasses and clovers (cut for seed or hay), green and root crops	1,027,338	1,020,647	..	6,691
Sown grasses not cut for seed or hay	15,912,803	16,112,598	199,795	..
Fallow lands	137,898	147,678	9,780	..
Gardens, orchards, tree-plantations, &c.	198,661	146,346	..	52,315
Unimproved land	25,386,928	25,146,974	..	239,954
Total area of occupied land	43,546,757	43,528,337	..	18,420

DETAILS OF UNIMPROVED OCCUPIED LAND: 1921–22.

Land District.	Phormium Tenax.	Tussock and other Native Grasses.	Fern, Scrub, and Second Growth.	Standing Virgin Bush.	Barren and Unproductive Land.	Total Unimproved Occupied Land.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
North Auckland ..	2,211	215,641	789,051	372,711	81,058	1,460,672
Auckland	6,739	293,498	1,104,250	784,694	57,911	2,247,092
Hawke's Bay ..	621	569,492	460,473	310,130	37,838	1,378,554
Taranaki	67	5,718	74,545	295,439	5,558	381,327
Wellington.. ..	15,403	538,777	319,326	414,758	98,795	1,387,059
Nelson	1,916	352,465	138,865	441,849	42,492	977,587
Marlborough ..	754	1,305,245	235,333	215,169	325,438	2,081,939
Westland	6,980	134,028	93,804	1,036,182	327,210	1,598,204
Canterbury.. ..	2,542	4,203,684	98,560	239,354	668,467	5,212,607
Otago	958	5,578,143	403,626	292,572	286,317	6,561,616
Southland	5,705	1,412,912	180,276	176,427	84,997	1,860,317
Totals	43,896	14,609,603	3,898,109	4,579,285	2,016,081	25,146,974

NOTES.—Land in boroughs is excluded from the above statistics. The total area of New Zealand is 66,292,232 acres.

REVIEW.

THE GEOMORPHOLOGY OF NEW ZEALAND.

A NOTABLE book* has recently appeared from the pen of Professor C. A. Cotton, D.Sc., F.N.Z.Inst., which must forthwith not only take a high place in that captivating branch of science to which it belongs, but is assuredly destined to stand out—a conspicuous landmark—in New Zealand's scientific history.

The term "geomorphology" can hardly suggest to the uninitiated any reason for the work being the subject of a review in a journal devoted to agriculture, even in its widest sense. But geomorphology is that science, related to geology on the one hand and geography on the other, which is concerned with those numerous features of the landscape—mountains, valleys, plains, rivers, lakes, &c. —which together make up the surface of any country; and it seeks to classify them, explain their origins, and determine their destinies. This explanation should make clearer the relationship of agriculture to geomorphology, for is not the former governed, in no small degree, by the forms of the earth's surface where its operations are carried on? An alluvial plain, a hollow between coastal dunes, a gentle or a steep slope, the irregular surface of an ancient moraine—to mention a few common land-forms—each of these usually demands its special agricultural treatment. Long before there was any agriculture each distinct land-form had its particular type of vegetation, modified, of course, by climate and soil, and it has been shown clearly enough from New Zealand farming that the plant covering, where still virgin, gives a definite clue to the agricultural usage to which the land may be put. The practical farmer may not be particularly concerned with the geomorphology of his farm—his main business being to use his land to the best advantage—nevertheless, some of the teaching in the book under review concerns him closely.

Thus the author calls attention to the effect of erosion on the natural vegetation, and shows that there is a "critical slope," varying with the nature of the rocks and the climate, but, so far, only to be learnt by experience, from which it is just possible to remove the forest and replace it by artificial pasture. But deforest steeper ground, and "not only the hill-slopes are rendered barren, but neighbouring valleys are also injured." It is a well-known fact that much land, thought suitable to carry grass, has been ruined for agricultural purposes in New Zealand through injudicious removal of forest, which should have been left intact.

Generally, the changes in a land-form are of unthinkable slowness, but in some instances they are so rapid as to directly concern the farmer. Thus the author points out how the changes brought about by a meandering river make "rivers unsuitable for geographical or farm boundaries. Old and new maps of the same river-valley will show the meanders in quite different positions and in quite different shapes," as exemplified by changes in the River Taieri (Otago), of which a map is given. Coastal sand areas, in particular, are subject to rapid change. The methods of farming, afforesting, and stabilization of such are based altogether upon a close study of their geomorphology in conjunction with their natural vegetation. A striking case of the effect of a heavy thunderstorm a few years ago in destroying buildings and an orchard situated upon an apparently stable alluvial fan in the Dunstan Gorge (Central Otago) is still to be seen. The aggrading of river-beds and the burial of good grassy flats is not uncommon in mountainous country, especially where forest has been destroyed by fire near the sources of the rivers.

* "Geomorphology of New Zealand—Part I, Systematic: An Introduction to the Study of Land-forms." Demy 8 vo, 462 pp., with 442 illustrations. New Zealand Board of Science and Art, Wellington, 1922. Bound in cloth, 22s. 6d.; in paper cover, 18s.

But if not of particular interest to the actual farmer, this text-book of geomorphology should be in the hands of every student of agriculture, agricultural instructor, and those—a far too small band at present—engaged in agricultural research. At the present time nearly all the University students of an agricultural bent rightly include geology in their curriculum, and in this the study of land-forms plays an important part. As agriculture is largely applied ecology, the importance of Professor Cotton's book for those engaged in agricultural research need hardly be stressed; while, so far as pure botanical ecology is concerned, now that the work is to hand, it is difficult to understand how one carried on without it.

Coming now to the actual contents, scope, and methods of the book, that which especially impressed the reviewer was the manner in which each chapter of the several major subjects under discussion leads up to the next, the series of chapters being bound together much as are the propositions of a book of Euclid. This interdependence and almost mathematical precision is the outcome of the special terminology of the work, term after term appearing and being carefully defined, while each leads up to some new conception. Doubtless a good deal of criticism will centre round this somewhat excessive employment of technical terms. But to reduce their number would be to do away not only with the author's well-conceived method, but also to destroy the interlocking sequence of chapter after chapter, and injuriously affect the clarity of the presentation and the precision aimed at in the description of the landscape. The sole criticism here offered on this head is that a glossary of terms would have been of great assistance, notwithstanding that each term is defined when it first appears.

Hand-in-hand with the text go no less than 442 explanatory figures—some photographs of actual land-forms in New Zealand, and others diagrammatic and explaining the evolution of most of the geomorphological units. To these diagrams, almost all of which are from the hand of the author himself, unstinted praise must be accorded; indeed, they are perhaps the outstanding feature of the work, if any part may be so designated. But many of the photographs are excellent, helpful, and of special value in illustrating the author's descriptions, and not for the student alone, but also for the general reader, either when leisurely reading the book or when travelling through the country. Many not interested in science should also find these photographs attractive, for they give a rapid glance of New Zealand's scenery with its mountains, glaciers, lakes, rivers, waterfalls, gorges, volcanoes, hot springs, fiords, and the varied landscape of the coast.

Although the presentation of the subject is based upon the work and ideals of that United States school of geomorphology of which W. M. Davis is now the leader and G. K. Gilbert the pioneer, Cotton's work is no mere copy. Page after page reflects the author's own researches, and is illuminated by his well-considered conclusions. But in considering these researches those of other New Zealand workers in the geomorphological domain must not be forgotten, and to them, indeed, full recognition is accorded.

The conception of "cycles of erosion" forms one of the most alluring features of the book. First of all, there is the uplifted surface—itself of many forms—into which, as times goes on, gullies are cut by the action of water, which widen into valleys; debris is being constantly removed; change after change takes place—land-forms appear only to disappear; youth fades away; so, too, with maturity; and finally comes old age, when, at its close, the original high land will be worn down, in an ideal case, to about the level of the sea.

Deeply interesting is the account, based on the author's special researches, of ancient land-surfaces, long buried by deposits of various kinds, but again brought to the light of day, the covering material having been stripped off by erosion. Such the author calls "fossil plains." Land-forms of this kind can be seen in various localities when travelling by the Otago Central Railway.

There are many more topics dealt with in the book, but a consideration even of a few would lead too far. Suffice it to say, each page contains information, frequently of surpassing interest, not for the scientific student alone, but for that gradually increasing band of readers who love Nature and are eager to know something of her methods of working; these, as they fascinated read, will learn with wonderment how, with the simplest tools, she raises to the heavens the most sublime monuments, ever building, ever destroying!

L. COCKAYNE.

WEATHER RECORDS.

JANUARY, 1923.

The following general summary and rainfall statistics are supplied to the *Journal* by the Director of the Dominion Meteorological Office (Mr. D. C. Bates) :—

The weather for the month of January was remarkable for the number of wet days as well as a heavy rainfall, especially in the north-eastern districts of both Islands. The total falls so far reported by post and telegraph show that over the greater part of the Dominion the quantities recorded were from two to three times greater than usual in the same period in former years; but in the west coast and southern districts of the South Island the rainfall was below the average. There were some very heavy downpours scattered throughout the Dominion, mostly occurring at the time of electric disturbances, which were quite common. The winds were variable, but easterlies had a predominance. The most striking feature of the meteorological conditions was the small range of barometric pressure in all parts of the country, this being less than half an inch, and the readings below the normal nearly the whole time.

Dull and misty weather with warm and humid conditions were prevalent, and made hay-harvesting a very trying business for the farmers.

RAINFALL FOR JANUARY, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	..	..	..	3·36
Russell	3·18	9	0·94	4·54
Auckland	6·44	15	2·14	2·57
Hamilton	5·34	19	0·90	3·70
Kawhia	5·00	14	0·98	3·37
New Plymouth	12·29	18	4·86	4·32
Inglewood	17·48	21	7·17	7·31
Whangamomona	13·04	20	3·40	5·82
Tairua, Thames	4·48	13	0·72	4·12
Tauranga	6·12	16	2·12	4·35
Maraehako Station, Opotiki	7·82	17	1·98	2·87
Gisborne	5·90	14	1·44	2·77
Taupo	6·95	15	2·76	3·46
Napier	..	..	..	3·03
Taihape	8·40	19	2·12	3·03
Masterton	6·52	18	1·39	2·62
Patea	10·20	17	3·94	3·38
Wanganui	4·78	9	2·14	2·84
Foxton	5·23	13	0·78	2·11
Wellington	5·77	18	1·69	3·32
South Island.				
Westport	6·78	20	2·60	0·86
Greymouth	5·91	18	2·38	9·04
Hokitika	8·39	22	2·92	9·84
Arthur's Pass	7·42	13	1·78	6·75
Okuru, Westland	8·46	11	2·16	12·86
Collingwood	13·18	19	4·62	6·95
Nelson	8·26	23	1·70	2·76
Spring Creek, Blenheim	6·89	17	1·30	2·22
Tophouse	8·98	22	2·00	5·16
Hanmer Springs	8·72	19	1·90	3·30
Waiau	5·45	15	1·31	2·47

RAINFALL FOR JANUARY, 1923—*continued*.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Gore Bay (North Canterbury)	4·73	17	1·21	2·47
Christchurch	5·48	16	3·23	2·15
Timaru	4·65	21	1·04	2·28
Lambrook Station, Fairlie	4·49	17	1·22	2·34
Benmore Station, Omarama	4·19	22	0·67	2·66
Oamaru	1·70	10	0·68	2·15
Queenstown	1·78	12	0·45	2·71
Clyde	3·23	15	0·69	1·72
Dunedin	2·95	17	0·55	3·39
Gore	..	..	..	3·34
Invercargill	3·14	17	0·68	4·17

ESTIMATED YIELDS OF WHEAT AND OAT CROPS.

THE following estimated average yields per acre of wheat and oats for the season 1922–23 have been compiled by the Government Statistician from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 7th February :—

District.	Wheat. Bushels per Acre.	Oats. Bushels per Acre.
North Island	30·35	35·45
Nelson	26·96	30·00
Marlborough	33·47	44·11
Canterbury	29·97	36·54
Otago	32·18	41·90
Southland	36·66	46·73
Average (estimated) for the Dominion, season 1922–23	30·48	39·50
Average (actual) for the Dominion, season 1921–22	29·94	39·56

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 8,500,000 bushels, as against an actual yield of 10,565,275 bushels for the season 1921–22 (when a greater acreage was sown).

The percentage of oat crop threshed for the five seasons ending with 1921–22 was 31·49 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be 5,000,000 bushels, as against an actual yield of 6,752,663 bushels for the season 1921–22.

IMPORTATION OF FERTILIZERS, DECEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 31st December, 1922 : *Sulphate of Ammonia :* United Kingdom, 91 tons ; Australia, 90 tons : total, 181 tons. *Gypsum :* Australia, 20 tons. *Nitrate of Soda :* United Kingdom, 110 tons ; Belgium, 10 tons ; Chile, 40 tons : total, 160 tons. *Basic Slag :* United Kingdom, 502 tons ; Belgium, 1,256 tons ; Luxemburg, 50 tons ; United States of America, 1,500 tons : total, 3,308 tons. *Bonedust :* India, 550 tons ; Australia, 455 tons : total, 1,005 tons. *Char-dust and Bone Char :* Australia, 215 tons. *Guano :* United Kingdom, 10 tons ; Malden Island, 1,415 tons ; New Caledonia, 1,565 tons : total, 2,990 tons. *Rock Phosphate :* Ocean Island, 6,300 tons. *Kainit :* United Kingdom, 125 tons ; France, 100 tons ; Germany, 315 tons : total, 540 tons. *Muriate of Potash :* Germany, 5 tons. *Sulphate of Potash :* United Kingdom, 10 tons ; Germany, 135 tons : total, 145 tons. *Potash, other :* France, 85 tons ; Germany, 125 tons : total, 210 tons. *Sulphate of Iron :* Australia, 46 tons. *Other Fertilizers :* United Kingdom, 1 ton.

BOARD OF AGRICULTURE ACT REGULATIONS.

PROCEDURE AS TO NOMINATIONS, ETC.

New regulations under the Board of Agriculture Act, 1913 (revoking those of 20th January, 1914), were gazetted last month, and are reprinted in full below. Preliminary action in regard to nominations, as prescribed, has been duly taken by the Director-General of Agriculture.

REGULATIONS.

1. In these regulations " Board " means the Board of Agriculture. " Society " means a society incorporated under the Agricultural and Pastoral Societies Act, 1908.

2. The manner in which societies may recommend persons for appointment as members of the Board shall be as follows :—

(1.) The North Island shall for the purposes of these regulations be divided into four districts, having the names and boundaries set forth under the heading of North Island in the First Schedule hereto ; and the South Island shall similarly be divided into four districts as set forth in the said Schedule under the heading of South Island. One member of the Board may be appointed on the recommendation of such of the societies as have their headquarters in each of the said districts.

(2.) The societies specified as Metropolitan Societies in the said Schedule shall for the purposes of these regulations be deemed to be the Metropolitan Societies for their respective districts.

(3.) The Director-General of Agriculture (hereinafter called the " Director-General ") shall, not later than the 21st day of January in the year 1923, and not later than the same date in every third year thereafter, send by registered post to the President (hereinafter called " the Metropolitan President ") of the Metropolitan Society in each of the said districts a list giving the names of all the societies having their headquarters within the district of such Metropolitan Society and which were incorporated on or before the 31st day of December next preceding the issue of the said list. In the event of a casual vacancy occurring in the membership of the Board the Director-General shall as soon as possible issue in like manner a similar list in respect of the district whose representation has ceased by reason of the said vacancy.

(4.) The Metropolitan President in each district shall, not later than the last day of January aforesaid, send by registered post to the President of each of the societies named in the said list a notice (in the form set out in the Second Schedule hereto) advising each society that it may send a delegate or delegates to a meeting to be held for the purpose of recommending persons for appointment by the Governor-General to the Board, and calling for nominations for such appointment to be sent in to the Metropolitan President not later than the last day of February. Every such delegate shall be a member of the society appointing him.

(5.) The Metropolitan President shall send to the President of each of the aforesaid societies, not later than the 9th day of March, a list of the nominees referred to in the preceding subclause, and shall also at the same time advise the societies of the date on which the meeting shall be held to elect a representative on the Board, such advice to be sent out at least twenty-one clear days before the meeting.

(6.) The meeting shall be held at such convenient centre in the district as may be decided upon by the Metropolitan President, and the notice shall give full particulars of the place and time at which the meeting will be held.

(7.) In the event of no nomination being forwarded to the Metropolitan President as provided in subclause (4) hereof a representative shall be nominated by the meeting of delegates.

(8.) The Metropolitan President shall be the delegate or one of the delegates of the Metropolitan Society at the said meeting, of which he shall be Chairman, and he may exercise thereat a casting-vote in addition to a deliberative vote.

(9.) The voting at the said meeting shall be by ballot, and, except as provided in subclause (12) hereof, every delegate of a society may exercise one vote and no more.

(10.) No person except the delegates of societies named in the list supplied as aforesaid by the Director-General shall speak or vote at the said meeting; and every delegate shall, before speaking or voting, produce to the satisfaction of the Metropolitan President a document signed by the President or Secretary of his society certifying that the delegate has been duly appointed by the said society to attend the said meeting, and setting out the number of financial members comprised in the said society on the 31st day of December next preceding the date of the meeting.

(11.) Every society advised as hereinbefore provided to be represented at any such meeting may send thereto one or more delegates according to the number of its financial members as stated in the certificate referred to in the last preceding subclause. The number of such delegates shall not exceed the following scale: 400 members or under, 1 delegate; over 400 and not over 800, 2 delegates; over 800 and not over 1,200, 3 delegates; over 1,200 members, 4 delegates.

(12.) If any society fails to send to any such meeting the full number of delegates corresponding to the membership of the society, the delegate or delegates sent by the society may exercise the full number of votes which the whole of the delegates of the society would have been entitled to exercise if present at the meeting.

(13.) At the time and place appointed for any such meeting the Metropolitan President shall, if more than one person is nominated to be recommended to the Governor-General for appointment to the said Board, take a vote as between the said persons. In the event of there being more than one candidate a ballot or ballots shall be taken, and the candidate at each ballot polling the lowest number of votes shall retire until (*a*) one candidate receives an absolute majority, when he shall be declared elected; or (*b*) only two candidates remain, in which case a further ballot shall be taken, and the one who receives a majority of votes shall be declared elected.

(14.) The Metropolitan President shall within three days after the said meeting notify to the Minister of Agriculture by registered letter the names of all persons so nominated, and, if a vote has been taken, the number of votes cast for each. The persons so nominated shall thereupon be deemed to have been recommended to the Governor-General in the order indicated by the number of votes cast for each.

3. Subject to the provisions of clause 5 hereof, each member of the said Board shall, when absent from home on the business of the Board, be entitled to a refund of his expenses of locomotion, and to a travelling-allowance of thirty shillings for each day or part of a day during which he is so absent.

4. The Board may, subject to the written concurrence of the Minister of Agriculture, set up one or more temporary special committees, consisting wholly or partly of persons not members of the Board, to inquire into and report to the Board upon any specified matter or matters.

5. Excepting in the case of his locomotion expenses and travelling-allowances in connection with attendance at meetings of the Board, no member of the said Board shall incur any charge against the public funds without first obtaining the written authority of the Minister of Agriculture.

6. The undermentioned officers may, unless otherwise requested by the President, attend any meeting of the said Board: The Director-General of Agriculture, the Director of Education, the Under-Secretary of Lands, and the Director of Forestry.

FIRST SCHEDULE.

North Island.

1. *The Auckland District.*—Comprising the Provincial District of Auckland, except the counties of Waiapu, Waikohu, and Cook. Metropolitan Society: The Auckland Agricultural and Pastoral Association.

2. *The Hawke's Bay District.*—Comprising the Provincial District of Hawke's Bay, together with the counties of Waiapu, Waikohu, and Cook. Metropolitan Society: The Hawke's Bay Agricultural and Pastoral Society.

3. *The Taranaki District.*—Comprising the Provincial District of Taranaki. Metropolitan Society: The Taranaki Metropolitan Agricultural Society.

4. *The Wellington District.*—Comprising the Provincial District of Wellington. Metropolitan Society: The Manawatu and West Coast Agricultural and Pastoral Association.

South Island.

5. *The Marlborough-Nelson-Westland District.*—Comprising the provincial districts of Marlborough, Nelson, and Westland. Metropolitan Society: The Nelson Agricultural and Pastoral Association.

6. *The Canterbury District.*—Comprising the Provincial District of Canterbury. Metropolitan Society: The Canterbury Agricultural and Pastoral Association.

7. *The Otago District.*—Comprising the Provincial District of Otago, except the counties of Southland, Wallace, Lake, Fiord, and Stewart Island. Metropolitan Society: The Otago Agricultural and Pastoral Society.

8. *The Southland District.*—Comprising the counties of Southland, Wallace, Lake, Fiord, and Stewart Island. Metropolitan Society: The Southland Agricultural and Pastoral Association.

SECOND SCHEDULE.

The President of the Society,

In accordance with the regulations under the Board of Agriculture Act, 1918, I hereby give notice that the Society is requested to send a delegate or delegates (according to the number of its members*) to a meeting to be held at the [*Name of building*] at [*Name of town*], at [*Hour*] .m., on day, the day of , 19 , for the purpose of recommending persons for appointment by His Excellency the Governor-General to the Board of Agriculture.

Nominations for such appointment may be made by your society, and must be forwarded to the undersigned on or before the last day of February, 19 .

Dated at , the day of , 19 .

[*Signature.*]

* See subclause (11) of clause 2 of the regulations mentioned.

EXPORT BUTTER-BOXES.

The Department is advised that several shipments of butter from New Zealand this season have been landed with an undue number of boxes broken in transit or discharge. In the case of one vessel repairs to broken boxes cost the shipping company over £57. Such charges, of course, tend to come back ultimately on the producer. In many cases lately the boxes used by our butter-factories have been made rather too light. The ends should be not less than ½ in. thick after double-dressing. Care should also be taken that the nails driven into the ends are well centred.

WORLD'S POULTRY CONGRESS, 1924.

Advices have been received by the Department from the High Commissioner, and from the President of the International Association of Poultry Instructors and Investigators (Mr. Edward Brown), London, that the Second World's Poultry Congress and Exhibition will be held at Barcelona, Spain, in 1924. The Congress will be under the auspices of the Barcelona Municipality, and have the support of the Spanish Government, while the Royal School of Agriculture and the Live-stock Breeders' Association of Spain will co-operate in the arrangements. The University of Barcelona has offered to accommodate the Congress in its fine buildings, and one of the buildings erected for the forthcoming Barcelona Universal Exhibition has been made available for an educational exhibition in connection with the Poultry Congress. An executive committee is in progress of formation which will in due course announce further plans and details for the Congress.

Cattle-tick Regulations.—Amending regulations under the Stock Act for the prevention of the spread of ticks (*Ixodidae*) among cattle were gazetted on 1st February. The amendments relate to the boundaries and crossing-places of declared areas in certain districts. The principal alteration is in the Bay of Plenty, where the Area A boundary has been moved back nearer Opotiki. Slight changes have also been made in the Rotorua and Coromandel districts.

THE FIREBLIGHT ACT, 1922.

THIS measure, the full title of which is "An Act to make special provision for the control of the disease of fruit and other trees known as fireblight," reads as follows:—

1. This Act may be cited as the Fireblight Act, 1922, and shall be read together with and deemed part of the Orchard and Garden Diseases Act, 1908 (hereinafter referred to as the principal Act).

2. In this Act "commercial fruitgrowing district" means a district declared as such by the Governor-General as hereinafter provided.

3. For the purpose of preventing the spread of and eradicating fireblight the Governor-General may from time to time, by Order in Council, declare any specified portion of New Zealand to be a commercial fruitgrowing district under a name set out in such Order, and may in like manner from time to time extend, vary, or abolish any such district.

4. The Governor-General may from time to time, by Order in Council, make regulations prescribing the trimming or cutting-down, in the manner and at the times specified, of all hawthorn growing within a commercial fruitgrowing district or any specified part thereof.

5. On being satisfied that fireblight exists in any commercial fruitgrowing district the Governor-General may, by Order in Council, prescribe the complete destruction within the time specified in the Order of all hawthorn growing therein or in any specified part thereof.

6. (1.) Every occupier of land within a commercial fruitgrowing district shall take such steps as may be prescribed pursuant to this Act to trim, cut down, or destroy hawthorn growing on such land.

(2.) If such occupier fails to take such steps he commits an offence against this Act; and any Inspector under the principal Act, or other authorized officer, may forthwith take such steps at the expense in all things of the occupier, who, nevertheless, shall not thereby be relieved from any other liability incurred by him under this Act.

7. Every person who commits an offence against this Act is liable to a fine not exceeding five pounds for a first offence, and not exceeding fifty pounds for a subsequent offence: Provided that no prosecution shall be instituted except by an Inspector under the principal Act.

8. Sections two and three of the Noxious Weeds Amendment Act, 1921, are hereby repealed; and all special orders made by local authorities pursuant to the Noxious Weeds Act, 1908, and that Act, declaring hawthorn to be a noxious weed within their districts or any part thereof shall, in so far as they relate to hawthorn, be deemed to be revoked as from the passing of this Act.

REGULATIONS.

Regulations under the Act were gazetted on 1st February, 1923. They define commercial fruitgrowing districts at Port Albert, Warkworth, Waitemata, Albany, Te Kauwhata, Thames, Hawke's Bay, Greytown, Waimea, Marlborough, Rangiora, Christchurch, and Otago. In the Thames and Greytown districts, and in parts of the Waitemata and Albany districts, all hawthorn must, in the months of June and July each year, be cut down so as to prevent any part from flowering. In other parts of the Waitemata and Albany districts, and in the Te Kauwhata district, the complete destruction of hawthorn before 30th June, 1923, is required.

Beech-forest Investigation.—Dr. L. Cockayne, F.R.S., F.N.Z.Inst., has been engaged by the State Forest Service as honorary botanist to make a report on the beech (*Nothofagus*) forests of New Zealand. The habit and behaviour of the various beeches in the forest are very imperfectly known, so that the sylvicultural treatment required to secure beech-regeneration and a maximum and sustained yield of timber cannot at present be laid down. Dr. Cockayne's investigations are planned to supply the required knowledge.

SEED DISPLAY FOR BRITISH EMPIRE EXHIBITION.

THE Dominion Advisory Council of the British Empire Exhibition desires it to be known that it is intended to make a thoroughly representative exhibit of New Zealand seeds at the British Empire Exhibition. This can only be done through the co-operation of the farmers of the Dominion, whose effective support in this respect is requested. To assist co-ordination a sub-committee has been set up to take the matter in hand, comprising the following experts: Mr. H. C. Wilton, care of Messrs. Wright, Stephenson, and Co., Ltd., Wellington (agricultural seeds); Mr. F. Cooper, care of Messrs. F. Cooper, Ltd., Wellington (vegetable-seeds); and Mr. A. H. Messenger, State Forest Service, Wellington (tree-seeds). Farmers who consider that they can assist in assembling a first-class exhibit are requested to communicate as early as possible with any of the above-mentioned gentlemen, who will supply them with full information. The co-operation of the New Zealand Grain-merchants' Federation has already been sought by the issue of circulars to the individual members. For decorative purposes a considerable quantity of sheaves will also be required.

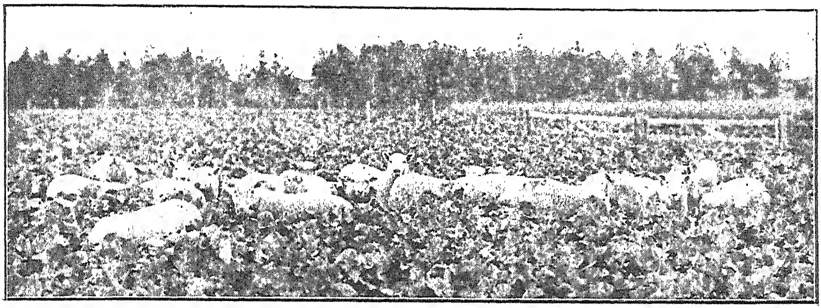
NEW ZEALAND VETERINARY ASSOCIATION.

ADVANTAGE was taken of the presence of a large number of veterinary surgeons in Wellington in connection with the Science Congress last month to hold a meeting to discuss the formation of a veterinary association for New Zealand. The point was stressed that at the present time there is no law in New Zealand to prevent unqualified men setting up as veterinary surgeons, and that so long as such a state existed so long would stockowners suffer by having their animals subjected to unskilled treatment. This position, in the interests of both the stockowner and the qualified veterinarian, required remedying, and an association could do much in this direction in influencing the powers that be, and educating the farmer in the value of obtaining professional advice for his animals. It was unanimously decided to form a New Zealand Veterinary Association, and a committee was appointed to draft a constitution. Mr. W. T. Collins, M.R.C.V.S., Department of Agriculture, Wellington, is acting as Secretary.

FORTHCOMING AGRICULTURAL SHOWS.

Masterton A. and P. Association: Masterton, 20th and 21st February.
Te Awamutu A. and P. Association: Te Awamutu, 21st February.
Omaha and Pakiri A. and H. Association: Leigh, 21st February.
Whakatane A. and P. Association: Taneatua, 21st February.
Rangitikei A. and P. Association: Taihape, 22nd February.
Opotiki A. and P. Association: Opotiki, 23rd February.
Franklin A. and P. Society: Pukekohe, 23rd and 24th February.
Rotorua A. and P. Association: Rotorua, 28th February.
Katikati A. and P. Society: Katikati, 1st March.
North Kaipara Agricultural Association: Paparoa, 1st March.
Taumarunui A. and P. Association: Taumarunui, 7th March.
Taranaki Metropolitan Agricultural Society: New Plymouth, 7th and 8th March.
Waikato Central Agricultural Association: Cambridge, 7th and 8th March.
Morrinsville A., P., and H. Society: Morrinsville, 14th March.
Methven A. and P. Association: Methven, 15th March.
Hawke's Bay A. and P. Society: 20th and 21st March (Autumn Show).
Temuka and Geraldine A. and P. Association: Temuka, 22nd March.
Matamata A. and P. Association: Matamata, 22nd March.
Mayfield A. and P. Association: Mayfield, 24th March.

New Rabbit District.—The constituting of the Apiti-Pohangina Rabbit District (Wellington Land District) under Part III of the Rabbit Nuisance Act, 1908, s gazetted.



The New Zealand

Journal of Agriculture.

Vol. XXVI.—No. 3.

WELLINGTON, 20th MARCH, 1923.

SHELTER-BELTS AND HEDGES AT RUAKURA.

THE EXPERIENCE OF TWENTY YEARS.

A. W. GREEN, Manager, Ruakura Farm of Instruction, Hamilton.

NOW that the Ruakura Farm of Instruction has been established for almost twenty years, it is possible to give some valuable information regarding the various shelter-belts and hedges planted during the early years of development. Fortunately, in the first place, the trees in these belts were well selected and planted in proper order, and since then have been well cared for. In every case wire fences protecting the trees from live-stock were erected, and have since been kept in sound repair. The planting and cutting-out later of nurse-trees is another factor which certainly has had a great influence over the present excellent state of these shelter-belts.

Those who have had experience in the growing of trees on wind-swept areas fully appreciate the value of quick-growing nurse-trees. They protect the slower-growing and more permanent trees from strong winds, draw them up straighter, and encourage more rapid growth. On the other hand, nurse-trees must not be allowed to remain too long in the shelters, and thinning-out is work which must be attended to at the right time. Many properly planted shelter-belts are ruined by allowing nurse-trees to remain too long. They

then overcrowd and finally kill the permanent trees, especially if such nurse-trees as pines are used. At Ruakura it has been found that *Pinus muricata* makes a most suitable nurse-tree in the shelter-belt. This pine is not so liable to overcrowd and will not rob the permanent trees to the same extent as *Pinus insignis*. Other trees thrive well when growing in close proximity to *Pinus muricata*, and it has remained very free from pests and diseases, which is an important matter. *Pinus halepensis* (Aleppo pine), *Pinus rigida* (American pitch-pine), and *Cryptomeria elegans* have been used to some extent, but in this district all have taken disease badly, and for this reason cannot be recommended. On poor lands *Pinus insignis* succeeds well as a nurse-tree, but care must be taken to cut it out immediately the permanent shelter-trees are sufficiently advanced to allow of thinning. It must be recognized that nurse-trees have other uses. They make good firewood, and at this station have been the main source of supply.

TREES AND SHRUBS WHICH HAVE GIVEN SATISFACTORY RESULTS.

At Ruakura the following trees have thriven and been found useful; they can be recommended for places with similar conditions :—

(1.) Trees suitable for a high single-row hedge: *Cupressus Lawsoniana* (Lawson's cypress), *Cupressus Benthamii*, *Cupressus Knightiana*, poplars and *Cupressus Lawsoniana* combined, poplars and *Pseudo-tsuga Douglasii* (Oregon pine) combined.

(2.) Trees suitable for a low single-row shelter hedge: (*a*.) Field hedges—*Berberis* (barberry), *Eleagnus japonica*, barberry and *Eleagnus* mixed, *Cupressus Lawsoniana* (well clipped). (*b*.) Garden or section hedges — *Juniperus communis hibernica* (Irish juniper), *Ligustrum sinensis* (Chinese privet), *Pittosporum Ralphii*, *Pittosporum tenuifolium*, *Cupressus Lawsoniana* (well clipped), *Podocarpus totara* (totara), (well clipped).

(3.) Trees suitable for mixed ornamental and shelter belts, planted three or four rows deep: (*a*.) Evergreen trees—*Cupressus macrocarpa*, *Cupressus Lawsoniana*, *Cupressus Benthamii*, *Sequoia sempervirens* (Californian redwood), *Wellingtonia gigantea* (Californian mammoth-tree), *Thuya gigantea* (Oregon white-cedar), *Pseudo-tsuga Douglasii* (Oregon pine), *Quercus sempervirens* (evergreen oak), *Pinus strobus* (Weymouth pine). (*b*.) Deciduous trees — *Betula alba* (white-birch), *Larix europaea* (English larch), *Fraxinus excelsior* (English ash), *Quercus robur* (English oak), *Juglans regia* (English walnut), *Juglans Sieboldiana* (Japanese walnut).

(4.) Trees suitable for planting in belts or corners for posts: *Eucalyptus Macarthuri*, *Eucalyptus fastigata*.

(5.) Trees suitable for planting in blocks for timber: *Pinus insignis*, *Cupressus macrocarpa*, *Sequoia sempervirens*, *Eucalyptus Macarthuri*, *Eucalyptus fastigata*.

(6.) Shrubs and trees suitable for an ornamental shrubbery of native trees: *Griselinia littoralis*, *Pittosporum Buchananii*, *Pittosporum Ralphii*, *Pittosporum tenuifolium*, *Olearia furfuracea*, *Olearia nitida*, *Persoonia toro*, *Panax arboreum*, *Hoheria populnea*, *Sophoro tetraptera* (kowhai), *Cordyline australis* (cabbage-tree), *Phyllocladus trichomanoides* (tanekaha), *Dacrydium cupressinum* (rimu), *Podocarpus spicatus* (matai), *Podocarpus dacrydioides* (kahikatea), *Podocarpus totara* (totara).

FIG. 1. CUPRESSUS LAWSONIANA AT RUAKURA.

These trees, planted thirteen years ago, have been allowed to make unchecked growth.

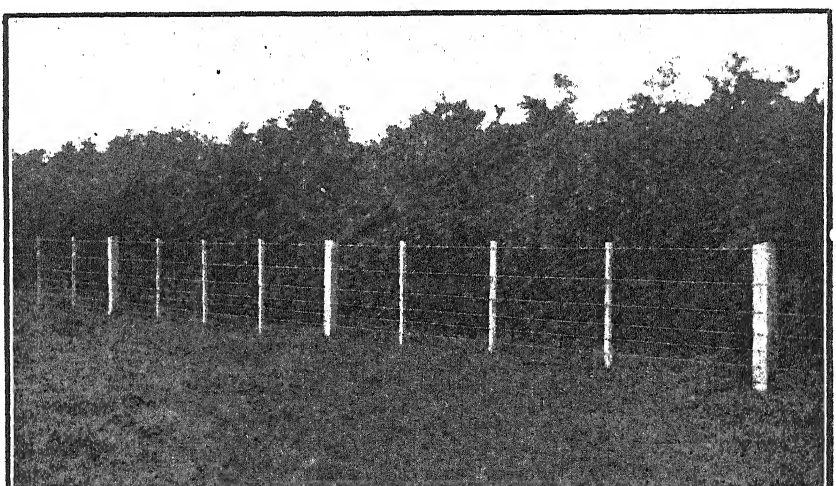


FIG. 2. HEDGE OF LAWSONIANA, RUAKURA.

Fourteen years old. Clipped yearly.

It may appear to many readers that numerous trees and shrubs have been omitted from these lists, but those enumerated have all been grown at Ruakura with satisfactory results.

NOT RECOMMENDED FOR RUAKURA CONDITIONS.

The following trees and shrubs cannot be recommended for planting on land and in positions similar to those at Ruakura:—

(1.) Attacked severely by pests and diseases: *Pinus halepensis* (Aleppo pine), *Pinus Sylvestris* (Scots pine), *Picea excelsa*, *Picea Menziesii*, *Cryptomeria elegans*, *Pittosporum eugenioides*, *Pittosporum crassifolium*, *Olearia Fosterii*, *Olearia Traversii*, *Viburnum Tinus* (laurestinus)

(2.) Killed or badly affected by frost: *Vitex littoralis* (puriri), *Corynocarpus laevigatus* (karaka), *Meryta Sinclairii* (puka), *Tecoma capensis*.

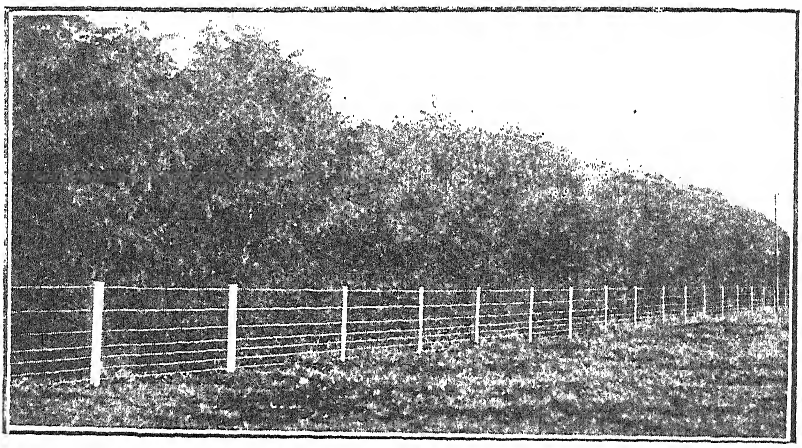


FIG. 3. CUPRESSUS BENTHAMII HEDGE, RUAKURA.

Eleven years old. Note the overhanging growth, affording shade as well as shelter.

SOME SPECIAL POINTS.

Attention may here be called to a few special points of interest in connection with the Ruakura plantings. It will be noticed that *Cupressus Lawsoniana* takes first place as an all-round ornamental and shelter tree. If allowed to grow unchecked it forms a high and beautiful tree, affording excellent shelter right to the ground, as shown in Fig. 1. If planted closer together in a single row and clipped once a year it forms an excellent dense wind-proof hedge (Fig. 2). The tree is easily raised from seed, readily transplanted, hardy and vigorous, fairly quick-growing, will succeed in a great variety of soils and situations, is practically free from pests and diseases, and is not palatable to live-stock. It has therefore many good qualities to commend it.

A splendid hedge of *Cupressus Benthamii*, eleven years old, is seen in Fig. 3. This variety of cypress had made heavier top growth than

Lawsoniana, and at a height of 9 ft. the branches overhang the protecting fences, thus affording valuable shade as well as shelter to live-stock.

Cupressus macrocarpa is omitted from the list of trees suitable for a high single-row shelter hedge. It must be admitted that in many instances it has been planted as a single-line hedge, but in most cases the results have been unsatisfactory. Such hedges are full of gaps, as trees of this species die out, not only when young, but at all stages of growth. Large heavy spreading branches are produced when the trees are planted in single lines, and, although useful for shade, bottom growth disappears as the trees grow old, and the value as a shelter hedge is lost. When planted for timber in blocks or wide belts the trees grow straight, producing useful trunks and few side branches.

Cryptomeria elegans is omitted as a shelter-tree, mainly on account of the lower branches dying and failing to give bottom shelter to a hedge or belt ; it also harbours numerous pests and diseases.

Under the heading of a low single-row hedge it will be noted that barberry and *Eleagnus* mixed is recommended. When planted together in this manner it is found that a more even and dense hedge is formed than with one of barberry alone ; and with the addition of barberry to the *Eleagnus* live-stock leave the hedge alone. *Eleagnus* has been omitted from the list of garden or section hedges, for in such positions it requires constant clipping and demands too much attention. It also harbours numerous garden pests and diseases.

Special reference is merited by *Pseudo-tsuga Douglasii* (Oregon pine). This tree has succeeded well at Ruakura in single-row hedges, in combination with poplars for a high breakwind, in deep plantations, and as a single specimen tree in the open. It is a tree which can be easily propagated and readily transplanted. The young trees produce masses of fibrous roots, and when properly wrenched they lift with excellent root-development. If planted with care and given a little attention the young trees will make rapid growth, and when once firmly established will soon form an excellent breakwind.

POINTS FOR INTENDING PLANTERS.

To inexperienced settlers intending to plant, this first and important advice is offered : (1) Select trees that will succeed in the class of soil and situation when planted ; (2) select trees most suitable for the purpose for which they are to be planted ; (3) select well-grown and well-rooted trees from nursery establishments when purchasing.

Remember that it is useless to plant a tender tree in an exposed position, a high-growing tree where only a shrub is required, or a slow-growing timber-tree when quick shelter is desired, and a complete waste of time to plant poorly rooted and badly raised trees. On the other hand, many excellent trees never thrive because they are badly planted and, when planted, completely neglected.

It is, of course, possible to group trees in order to combine ornament with shelter and shelter with timber. In most cases, however, when timber is the main object it will pay to confine the planting to timber alone, for in order to secure the best results in this direction trees of one class must be kept together and planted in deep breaks.

FIG. 4. ORNAMENTAL SHELTER-BELT AT RUAKURA, COMPOSED MAINLY OF BETULA ALBA (WHITE-BIRCH) AND CUPRESSUS LAWSONIANA.

FIG. 5. ANOTHER ORNAMENTAL SHELTER-BELT AT THE FARM, CONSISTING CHIEFLY OF BÉTULA ALBA (WHITE-BIRCH), PSEUDO-TSUGA DOUGLASII (OREGON PINE OR DOUGLAS FIR), SEQUOIA SEMPERVIRENS (CALIFORNIAN REDWOOD), AND PINUS STROBUS (WEYMOUTH PINE).

It is better, therefore, to plant waste corners or unploughable areas on a farm with timber-trees rather than endeavour to intersperse them in the hedges and smaller shelter-belts on the farm. In some cases the lay-out of the farm may allow of the planting of a heavy break of timber-trees along the boundary-fence against the prevailing wind, and this will provide excellent shelter as well.

CONCLUSION.

The value of ornamental and useful shelter hedges and trees round a homestead and on the farm cannot be overestimated. Beauty and use go hand-in-hand more frequently than we think, and the planting of trees will not involve a great increase in the cost of home-making. The cutting-out of so much native forest, particularly in the North Island, must have a marked influence over the country, and it is essential that more trees be planted. Without shelter it is impossible to bring in much of our waste and wind-swept areas.

No better demonstration could be given than that afforded by the Ruakura Farm. The 938 acres of original waste land, adjoining an area of 25,000 acres of open untouched swamp land, could not have reached its present high state of cultivation, with its excellent pastures carrying large herds of thriving sheep and cattle, had not shelter-trees been planted in the first instance. Combined with shelter is the beauty which these trees lend to the surroundings, and visitors from all parts of the world express delight at the beautiful lines of trees and hedges to be seen at this station.

A STANDARD WOOL-SHED FOR NEW ZEALAND CONDITIONS.

PLANS AND MATERIAL REQUIRED.

J. G. COOK, Wool Instructor, Live-stock Division.

IN different parts of the Dominion the writer has frequently noted the necessity for a good standard wool-shed, designed to fully meet the requirements of the sheep-farmer while having due regard to economy. With these considerations in mind the accompanying plans have been prepared, together with a list of material required. The plans provide for a four-stand shearing-board, a capacity suitable for fair-sized flocks, but the size of the shed can be increased or decreased according to individual requirement.

When choosing a site for the wool-shed a piece of ground on the crest of a slope, having a long gradual rise from one side and a short steeper fall towards the other, should be selected if possible. With such a site the sheep-yards are constructed on the rising ground, this allowing rain-water to get away quickly and providing good drainage. On the highest part of the site is placed the end of the shed where the woolly sheep will enter, this portion being built on the short piles. The rest of the shed is built so as to extend out over the fall in the ground,

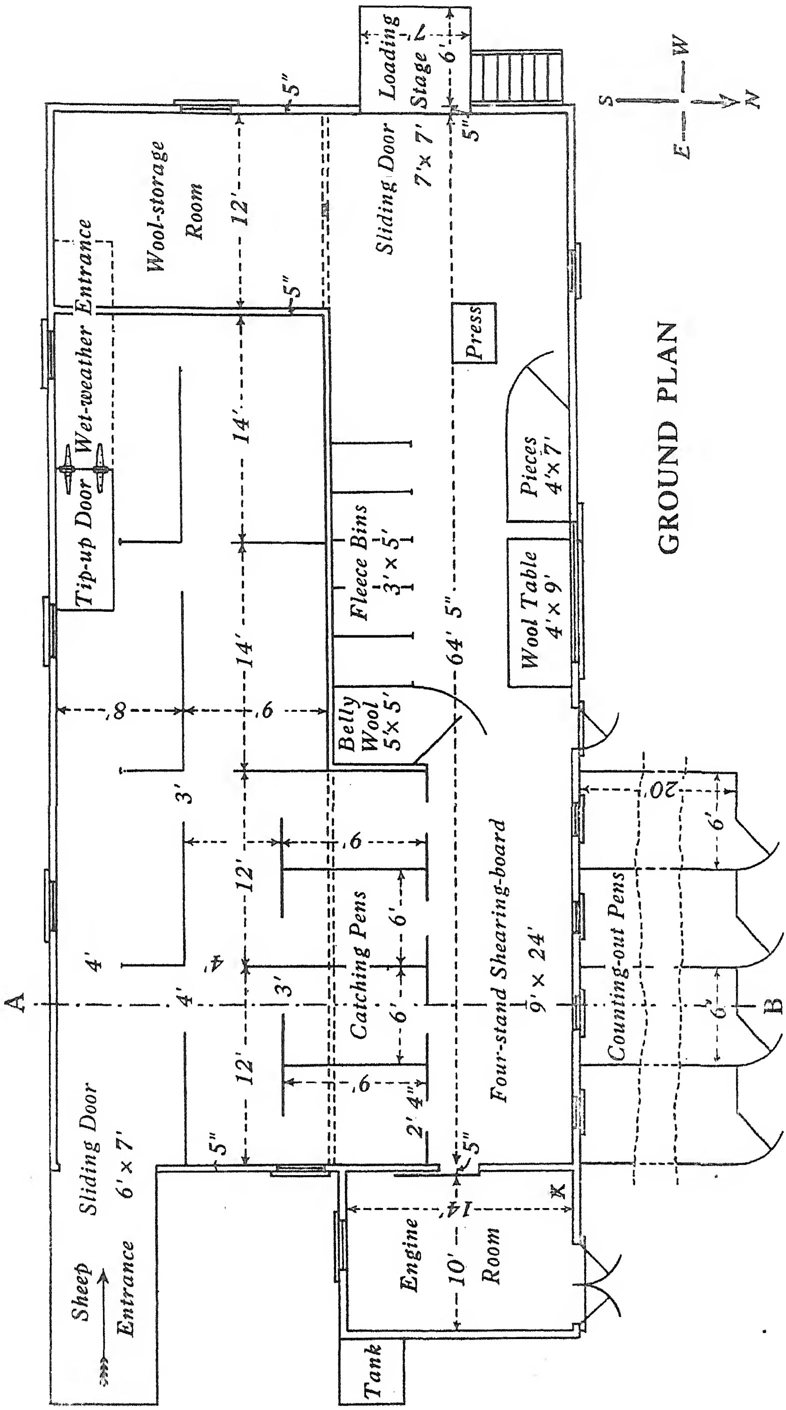
and rests on the longer piles. Placing the shed in this way serves a twofold purpose: (1) The height of the wool-room floor and loading-stage facilitates the loading of the wool wagons or lorries; and (2) the space under the wool-room floor may be used as a yard for holding woolly sheep, so as to give the shearers a fuller day's work in the event of broken weather occurring during shearing-time.

When making this yard under the wool-room floor the inner fence should be erected so that the yard does not extend under the grating forming the floor of the holding and catching pens. The yard is completed by wiring battens on the outside row of piles, leaving a door as shown. It is best to concrete this yard, as the bare ground would soon become contaminated with filth, and form a breeding-ground for disease. On the concrete floor gratings in sections should be put down. They are then easy to handle, and can be stacked up to allow the floor to be cleaned. A good bevel should be put on two sides of the battens forming the gratings, so that the bottom of each batten is narrower than the top. This allows manure to drop through readily, and keeps the surface of the gratings cleaner.

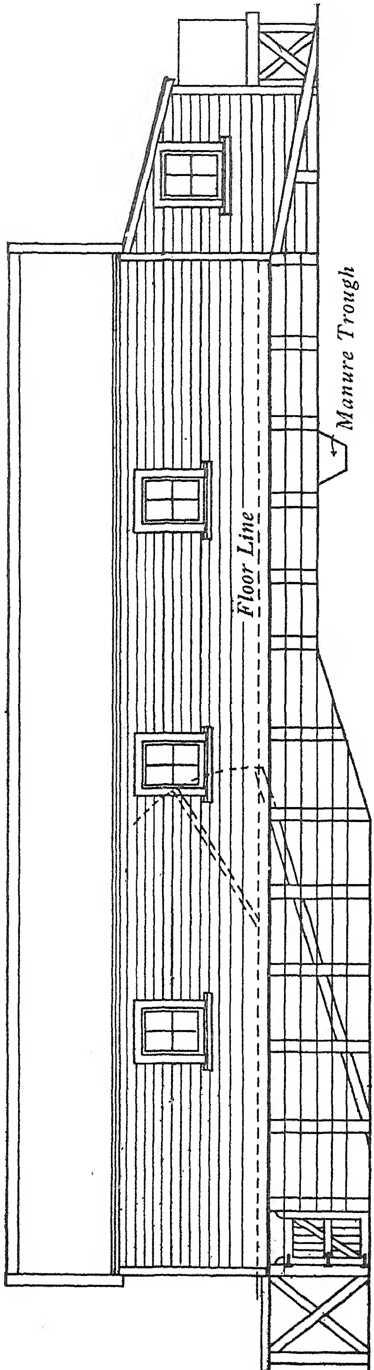
It is also advisable to concrete the counting-out pens, as these are then easily kept clean, so obviating the danger of an outbreak of blood-poisoning during shearing-time, which is always liable to happen when pens get into the foul condition inevitable with bare earth. The larger the number of sheep shorn, the greater is the danger of blood-poisoning, unless the pens are regularly cleaned out and either spread with lime or sprayed with a powerful disinfectant.

To bring the sheep from under the wool-room floor into the shed without taking them outside, a trap-door is cut in the grating of the inside holding-pens, as shown in the ground-plan, opening on to a battened race leading up from the lower yard, as shown in the south elevation. The dotted lines in the latter represent the trap-door raised to let the sheep come up. There is a small gate in the fence at the lower end of the race to keep out the sheep until required.

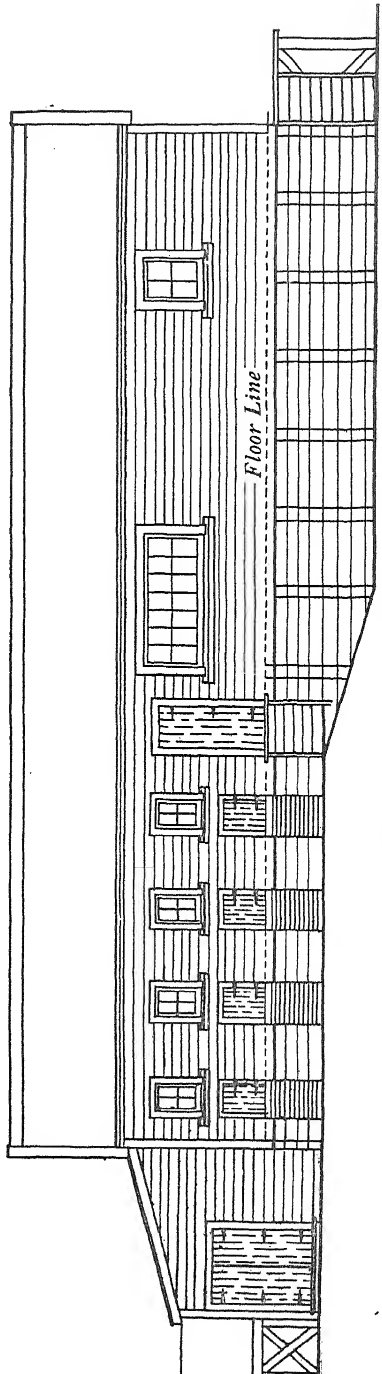
The shed shown in the plans is 32 ft. wide and 64 ft. 5 in. long, exclusive of the engine-room, which is 10 ft. by 14 ft.; but these measurements may be altered to suit requirements. The size of the wool-table should not be altered, unless to add length if the sheep are cutting big fleeces. A good bevel should be put on two sides of the battens forming the top of the wool-table, similarly to those of the gratings previously referred to. Any second cuts or other small pieces of wool which go between the battens will then immediately fall clear. If the battens are placed crosswise on the table greater strength is given than where they run from end to end. The wool-table can be fastened to the wall by strap hinges, and fixed so that the side next the wall will be somewhat higher than the outer side: a cant on the table makes the work easier. Instead of nailing the two legs on, it is better to bore an auger-hole through the table and legs and put a bolt through; or the legs may be strapped on with hinges; then after shearing-time it can be tipped up against the wall and tied, leaving the floor clear for other purposes. To keep the locks under the table two fairly wide boards are nailed on the inner side of the legs close to the lower end. Placing the boards on the inner side will make it more comfortable for the worker at the table by allowing more room for his feet.


Loading Stage
7'
6'
5"
Wool-storage Room
12'
Sliding Door 7'× 7'
Wet-weather Entrance
Press
Tip-up Door
14'
Pieces 4'×7'
Fleece Bins 3'× 5'
Wool Table 4'× 9'
64' 5"
Belly Wool 5'× 5'
8
6
3'
20'
Catching Pens
Four-stand Shearing-board 9'× 24'
Counting-out Pens
A
B
4'
Sliding Door 6'× 7'
2' 4"
Engine Room
10'
Sheep Entrance
Tank
S
W
E
N

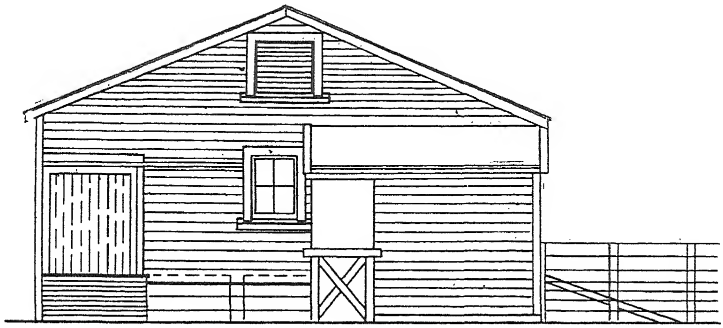
GROUND PLAN



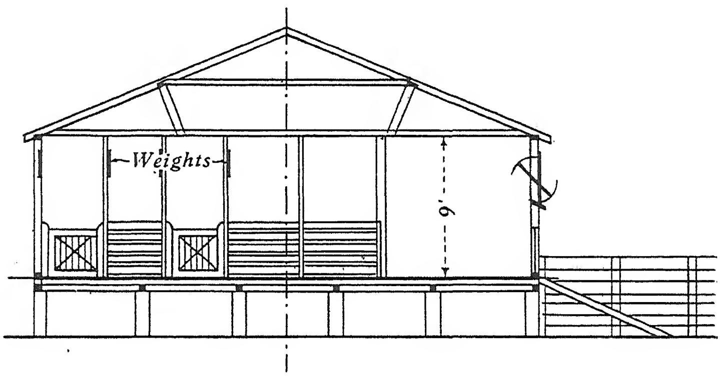
SOUTH ELEVATION



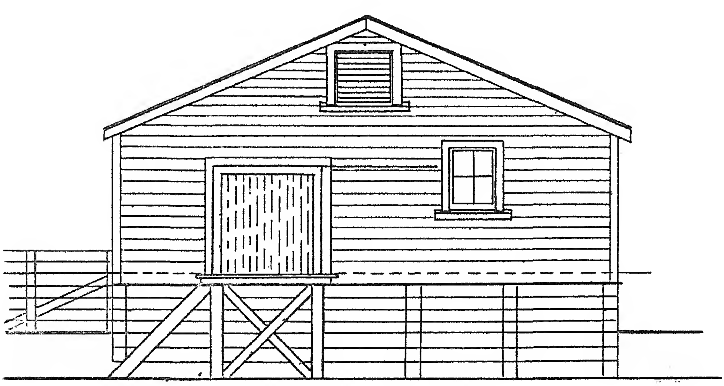
NORTH ELEVATION



EAST ELEVATION



SECTION ON A—B.



WEST ELEVATION

The door of the bin marked "Belly-wool" is 4 ft. by 5 ft., and is hung on strap hinges. In the bin marked "Pieces" the door is 4 ft. by 4 ft., and is also on strap hinges.

The wool-bins are 3 ft. wide, 5 ft. deep, and 7 ft. high, and this width and depth should not be altered. The tops of the bins may be boarded over, and the space above made use of at any time. The number of bins may be increased if necessary, and some used for pieces. All timber with which the wool comes in direct contact must be planed on one or both sides as required, this including the flooring-boards, the outer wall of the catching-pens, the back wall of the wool-bins, the partitions between the bins, and the whole of the wool-table. The studs of the shed are 9 ft. high, and on the shearing-board are of 4 in. by 3 in. timber. This is to give extra strength to that part of the wall where the machines are placed. The remainder of the studs are 4 in. by 2 in., and all corners are braced with 4 in. by 1 in. The dotted line in the ground-plan is for the centre beam, and an additional stud should be put in where the black square is shown.

The holding-pens in the shed can be altered to suit requirements, but should never be too large, because if the sheep get startled and crowd towards one end the whole pressure comes on to the animals against the rails at that end, and in a big pen these get badly bruised. The medium-sized pen will prevent serious results from this cause; there will also be less danger of smothering, especially at night-time. The plan shows single catching-pens—that is, one for each shearer. The reason for having these is that they do away with any cause of friction among the men; each shearer can suit himself whether he picks an easy shearing sheep or a more difficult subject. In the plan these pens are 6 ft. by 9 ft.

Slip-up gates with weights attached are the most convenient form, and, if desired, they may be made wider than is indicated in the plan. Those nearest the sheep entrance should be of a good width; the sheep will then enter better than if they had to come through narrow gates. The gates should never be placed in the middle of the side of a pen, as this makes it harder work to get the sheep through. In the plan they are put in the corner, so that the sheep come along a fence and go straight through the gateway. The height of the sheep-pens in the shed is 4 ft.

In the engine-room the grinding-wheel is situated at the point marked "X." The belt comes down off a pulley on the main overhead shafting, and should be near the wall at the end of the shearing-board.

Plenty of light is required in the shed, and the plan therefore shows six windows 3 ft. by 4 ft. in size, four 2 ft. by 3 ft. (one over each of the counting-out-pen doors), and a large window (4 ft. by 8 ft.) placed by the wool-table to enable the workers there to do their work thoroughly and expeditiously. A poor light at the table is a great handicap on clean, fast work. A couple of battens may be nailed across the lower part of each window in the sheep-pens in order to prevent breakage by the sheep.

The opening in each end of the shed shown as being louvred is so built that the louvres can be opened or closed as required. This enables the highest part of the shed to be thoroughly ventilated, especially during the night, which means a great difference in the state of the

air when work commences in the morning. As a further means of promoting good ventilation the sliding-door where the sheep enter the shed may be left open during fine weather, its place being taken by a hurdle which, after the shed has been filled, is put across the doorway and secured so that it cannot be shifted except by hand. At night as many doors, windows, and louvred ends should be left open as is consistent with safety, so as to allow a free passage of air through the shed to keep it cool and fresh.

In too many places it is found that the holding-room for woolly sheep is too small in proportion to the number of shearers on the board, so that in broken weather there is a good deal of time lost. By keeping the sheep close up to the shed, and making use of all available cover in the event of wet weather, the farmer can reduce to a minimum the time and money lost through wet weather.

A concrete manure-trough is provided as shown in the south elevation. This will be an incentive to clean out the manure from under the shed, thus keeping the ground floor clean and making the manure readily available for use in the garden, orchard, or elsewhere, instead of allowing it to go to waste and to poison the ground, as is too often the case.

Material required for Wool-shed shown in Plans.

Number.	Length.	Description.	Superficial Measurement.
	Ft.		Ft.
42	6	Piles	..
6	5	Piles	..
36	$2\frac{1}{2}$	Piles	..
12	19	Sleeper-plates, 4″ × 3″, V.D.L.	220
12	13	Sleeper-plates, 4″ × 3″, V.D.L.	156
80	16	Floor-joists, 5″ × 2″, 20″ centres	1,066
24	16	Wall-plates, 4″ × 2″	256
16	9	Studs, 4″ × 3″	144
102	9	Studs, 4″ × 2″	612
13	12	Studs, 4″ × 2″	104
12	16	Braces, 4″ × 1″	64
17	18	Ceiling-joists, 4″ × 2″	204
17	16	Ceiling-joists, 4″ × 2″	181
17	16	Collar-ties, 4″ × $1\frac{1}{2}$″	156
17	10	Struts, 4″ × 1″	56
38	18	Rafters, 4″ × 2″	456
4	16	Ridge-boards, 4″ × $1\frac{1}{4}$″	56
32	16	Purlins, 3″ × 2″	256
8	16	Purlins, 4″ × 2″	85
4	10	Angle-stops, 3″ × 2″	20
8	20	Fascia-boards, 5″ × 1″	80
3	14	Door-facings, 4″ × 1″	14
2	16	Door-facings, 4″ × 1″	10
2	18	Door-facings, 4″ × 1″	12
..	..	Weatherboards, 8″ × $\frac{3}{4}$″	2,400
..	..	Flooring-boards, T. and G., 6″ × 1″	1,150
67	10	Sheets, galvanized corrugated iron, $1\frac{1}{2}$ lap	..
67	9	Sheets, galvanized corrugated iron, $1\frac{1}{2}$ lap	..
9	8	Ridging-iron, 16″, or, if exposed to heavy wind, 18″, with lead tip	..
..	138	5″ spouting, with 3″ downpipe to lead on to roof of engine-room to allow water to run into tanks	..

Material, &c.—continued.

Number.	Length.	Description.	Superficial Measurement.
	Ft.		Ft.
1	..	Framed sliding-door, 7′ × 7′	..
1	..	Framed sliding-door, 6′ × 7′	..
1	..	Hinged ledge door 2½′ × 6½′	..
1	..	Ledge sliding-door, 2½′ × 6′	..
4	..	Counting-out-pen doors, 2′ × 2¾′	..
4	..	Catching-pen doors, 2′ 4″ × 4′	..
7	..	Windows, 3′ × 4′	..
4	..	Windows, 2′ × 3′, one at each shearer's stand	..
1	..	Window, 4′ × 8′, at wool-table	..
2	..	Louvred ends	..
		Sheep-pens in Shed.	
..	5,200 lin.	Battens, 2″ × 1″	870
..	440 lin.	Plates, 4″ × 2″	293
72	9	Studs, 4″ × 2″	432
4	12	Braces, solid, 4″ × 2″	32
..	650 lin.	Dressed division for pens, 5″ × 1″	..
..	..	Partition separating pens from shearing-board and back of wool-bins, 6″ × 1″	500
9	..	3′ × 4′ gates, with weights attached ..	..
5	..	4′ × 4′ gates, with weights attached ..	..
		Partitions for Wool-bins (Dressed Timber).	
6	7	Studs, 3″ × 2″, for front of partition ..	21
6	7	Studs, 2″ × 2″, for back of partition ..	14
18	5	Battens, 4″ × 1″, ledging for partitions ..	30
60	7	Battens, 6″ × 1″, partitions for bins ..	210
		Engine-room, 10 ft. × 14 ft.	
1	14	Sleeper-plate, 4″ × 3″, V.D.L.	14
1	10	Sleeper-plate, 4″ × 3″, V.D.L.	10
1	4	Sleeper-plate, 4″ × 3″, V.D.L.	4
2	10	Wall-plates, 4″ × 2″	13
1	14	Wall-plate, 4″ × 2″	9
14	12	Studs, 4″ × 2″	112
6	14	Studs, 4″ × 2″	56
2	12	Braces, solid, 4″ × 2″	16
4	14	Purlins, 3″ × 2″	28
6	10½	Rafters, 4″ × 2″	42
7	11	Sheets, galvanized corrugated iron, 1½ lap ..	..
1	14	5″ spouting, with downpipe to tank.. ..	..
..	..	Weatherboards, 8″ × ¾″	420
2	..	3′ × 8′ framed hinge doors	..
..	..	Concrete floor	..
..	..	Tank and stand (outside)	..
		Sheep-pen Gratings under Wool-room Floor.	
..	5,000 lin.	Battens, 2″ × 1″	833
..	400 lin.	Plates, 4″ × 2″	266

The total cost of doors, windows, gates, and louvred ends made at the factory is approximately £50. The estimated cost of the other materials listed, together with sundries such as nails, &c., is estimated at £275, Wellington prices in each case. The cost of materials for concreting floor of engine-room, sheep-pens, under shed, and the counting-out pens must be added.

COLLEGE ALGERIANS: A NEW STRAIN OF OATS.

THE plant-breeding work at Canterbury Agricultural College (Lincoln), which the Department of Agriculture has subsidized for the past three or four years, has resulted in the production this season of an improved strain of Algerian oats. Dr. F. W. Hilgendorf, Biologist to the College, contributes to the *Journal* the following outline history of the strain, which is designated as "A 86":—

1917.—In this year one hundred heads were selected from a commercial crop of Algerian oats, and the seed from each head was sown in a single row side by side in a bird-proof enclosure. Notes were made on the rapidity of growth of the various rows; the whole plot was fed off by a pet lamb three times (in May, June, and September), and the rapidity of recovery after feeding-off was noted. Strength and length of straw were observed, and all the hundred rows were threshed separately, and the quantity and quality of grain were measured. On all these points taken together ten strains were selected out of the hundred, and of these ten A 86 was one.

1918.—These ten strains were again sown in a bird-proof enclosure—each strain in a small plot about 10 yards by 1. They were again fed off (in April, June, and August), and again the tillering-capacity and recovery after feeding were noted. Each plot was threshed separately, and the notes regarding growth and yield allowed three to be selected out of the ten; of these three A 86 was one.

1919.—The three strains were sown in plots of about one-twentieth of an acre each, in an open field, and on each side of each strain was sown, under exactly the same conditions, the best commercial Algerian seed that could be bought in Christchurch. Strains and commercial plots were fed off twice, and the strains recovered slightly more rapidly that the check plots. The best tillering strain was A 86, and its yield was at the rate of 68 bushels per acre, as compared with 59 bushels from the commercial seed on each side of it. On the work of this year the three strains were reduced to two, of which A 86 was somewhat the better.

1920.—The two strains were each divided into two parts and sown on two half-acre plots, with commercial seed between and on each side of them. The resultant yield for the finally selected strain was as follows:—

Commercial	49·6 bushels per acre.
A 86	*60·8* ,,
Commercial	53·5 ,,
A 86	*59·1* ,,
Commercial	41·2 ,,

1921.—Previous to this year the seed had been sown thinly—namely, at the rate of 1 bushel per acre—so as to make it go as far as possible, and this probably explains the somewhat low yields so far. It was obvious that A 86 was at an advantage in the

thin sowing because of its great tillering-power, so full seedings of 2 bushels per acre were now arranged for. The plots were each about an acre in extent, and the following yields were obtained:—

Commercial	76·4 bushels per acre.
A 86	82·2 ,,
Commercial	74·3 ,,
A 86	77·5 ,,
Commercial	66·4 ,,

1922.—The two strains so far retained had both proved superior to commercial seed, but there was some difficulty in determining which to finally keep. The two strains were therefore sown in the same field—about 18 acres of each—and a comparison made of their characters in their adjacent parts right across the field. The superior tillering-power of A 86 made it more resistant to the abnormal frosts of the winter of 1922, and it was decided that it was the better strain —a decision which was corroborated by the final yield.

As a result A 86 was finally selected, and is now on sale under the name of "College Algerians." The strain is characterized by high tillering-power, a creeping habit of growth, quick recovery after feeding-off, a high degree of uniformity during growth and ripening, good yielding-capacity, and a good and uniform grain-sample.

Unfortunately the seed has become contaminated with wild oats during recent years, owing to its being sown in a field where these pests were lying unsuspected in the soil. The College was therefore unable to handle the bulk of seed, and so it (together with the runner-up strain) has been handed to Wright, Stephenson, and Co., Christchurch, to clean as well as possible and to distribute. A few bushels have been hand-picked, and a start made to build up a new lot for distribution.*

It is to be noted that the good results from this strain were produced under Canterbury conditions, and there is therefore no certainty that they will be repeated in other climates—for example, that of the North Island.

Summary.

1917–18: The strain A 86 was among the best out of 100 strains, regard being had to tillering, growth, recovery after feeding, and quantity and quality of grain.

1919–22: A 86 averaged about 10 bushels per acre above commercial seed sown under the same conditions.

There is no guarantee of suitability to other climates, nor of absolute absence of wild oats from the 1923 sample.

* Since writing, a sack sample of the seed has been received from Messrs. Wright, Stephenson after dressing, and a fairly careful examination seems to show that the wild oats have been successfully removed.

Death Duty and Plantations.—The point has been raised lately as to whether plantations of trees established by farmers or other persons are subject to death duty. The State Forest Service points out that the statutory definition of "land" under the Death Duties Act, 1921, excludes "native bush or trees which have been planted for shelter or ornamental or utility purposes." The effect of this appears to make such plantations exempt from death duty.

THE POISONOUS, SUSPECTED, AND MEDICINAL PLANTS OF NEW ZEALAND.

(Continued.)

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

COMPOSITAE—*continued.*

BEFORE leaving the subject of the rangiora (*Brachyglottis rapanda*) some additional evidence as to the poisonous nature of this species may be given. Mr. D. Sinclair, of Terrace End, Palmerston North, wrote on 5th April, 1915, that he had a saddle-horse become tipsy, or almost unable to stand up, from having eaten some rangiora. From Mangamaire, Upper Wairarapa, a correspondent wrote on 22nd December, 1914, that he had just lost three cows, and the only thing that could possibly have hurt them was one rangiora-tree in full flower which the cows had been eating. Another cow in the same paddock was drunk from the same cause, and could only just walk. The owner stated that he had seen a horse affected in just the same way as was this cow after eating rangiora, but had never experienced having cattle poisoned by it before.

A Taihape farmer, in August, 1914, sent to this Laboratory the stomach-contents of a yearling heifer calf. He had lost two within a few weeks, although the stock were in good condition and had plenty of pasture and hay. The owner was at a loss as to the cause of the deaths, the symptoms being, according to his description, that the calves seemed to lie about as if sleepy, and then die without a struggle. There was, he added, a little tutu and rangiora growing on the place. Upon examination in the laboratory the stomach-contents were found to consist largely of fragments of the leaves of rangiora.

A Wanganui settler, in August, 1900, informed the writer that rangiora was most poisonous to horses in winter. He had known a few to die, but the majority recovered, the symptoms being staggering as if drunk, and swelling of the head and legs. Those which recovered were always "groggy on their pins" for a few weeks.

Mr. Elsdon Best, in September, 1900, reported from Ruatahuna that horses sometimes die of eating wharangi, blood-letting and violent exercise being the native cures. His own horse, shortly before writing, was "wharangied," and had to be taken for a three-mile sharp canter as a cure.

A correspondent on the Wanganui River, in February, 1906, wrote that rangiora is better known as the "paper-leaf," and that he had seen a good many horses drunk from eating it, but did not know of a single instance of a horse dying from it. In fact, the packhorses in many places lived and thrived on it, and got very fond of it. As soon as an affected animal was worked so as to get heated and to sweat, the effects wore off. This correspondent also related a case of poisoning by honey on 20th November, when the rangiora would be in flower. Three bushmen were poisoned, but gradually recovered. He stated that the Maoris never take the wild honey when the rangiora is in blossom.

Centipeda orbicularis (*Cotula minuta* Forst.), a small native weed usually found in swampy places in the North Island, is stated by Lauder Lindsay to be possessed, under certain circumstances, of pungent, irritant, or sternutatory properties, causing sneezing when bruised under the nose.

Celmisia sp. is the native " cotton-plant " or " horse-daisy " of the New Zealand mountains. In Otago one or more of the species is dried and smoked as tobacco. Neil (1889), (" N.Z. Herb Doctor," p. 495), states that it relieves asthma.

APOCYANACEAE.

A great many plants of this family are physiologically active, and some of them intensely poisonous. The New Zealand representatives are small climbing shrubs of the genus *Parsonsia*, with yellowish-white or pink flowers produced in great profusion. There are two species—*P. heterophylla* and *P. capsularis*. They probably contain saponins, and from the fact that they belong to such a poisonous family are worthy of chemical investigation.

GENTIANEAE.

The genus *Gentiana*, which includes the beautiful gentians of our New Zealand mountains, is remarkable for the bitter principle which every member contains. Possibly some of the larger species might be made to yield a gentian root or gentian bitter similar to the well-known imported tonic.

CONVOLVACEAE.

Calystegia sepium—the pohue of the Maori and the bindweed of the settler—is a widely spread weed, and one which in the Northern Hemisphere is undoubtedly poisonous. Long remarks that the two species *C. sepium* and *C. arvensis*, when eaten in considerable quantity, appear to be cathartic and purgative, causing symptoms similar to those due to jalap. Colenso (" Essay," p. 31) remarks that the roots of *C. sepium* were cooked and eaten by the Maoris. Lauder Lindsay remarks that the large tuberous rhizomes, although eaten by the Natives, are in Europe regarded as poisonous, and yield a resin resembling scammony, which is a general characteristic of the *Convolvaceae*, although there are marked exceptions, such as *C. batatas*, the sweet-potato. Dr. Hooker very justly remarked that the properties of the same species may vary eminently in various localities. This is notoriously the case in many medicinal plants which are of violent action in one climate and innocuous in another. It is not to be thought, however, that because the roots are edible when cooked by the Maori they are non-poisonous when raw.

SOLANACEAE.

This is a family containing many poisonous and many useful plants, but in New Zealand there are only two native representatives—*Solanum nigrum*, the " garden nightshade," and *S. aviculare*, the poroporo of the Maori. *S. nigrum* is widespread throughout the world. Cases of poisoning in stock, calves, sheep, goats, and pigs are recorded in other countries. Long remarks that though it must always be regarded as poisonous, the plant varies considerably in toxicity according to soil, climate, and general conditions of growth. The symptoms of poisoning

are apparently much the same in man and animals — stupefaction; staggering; loss of speech, feeling, and consciousness; cramps; and sometimes convulsions. The pupil is generally dilated. The writer has come across one case in New Zealand in which lambs confined to a paddock on which was a large aftermath growth of *S. nigrum* went off in condition and a number died.

SCROPHULARINEAE.

Veronica is the only New Zealand genus of this large family (which derives its name from the supposed virtues of some of its members in curing scrofula) of which anything can be said. There are many medicinal plants belonging to the family, perhaps the best known now being the *Digitalis* (foxglove), which will be discussed later in this series of articles.

The leaves of some of the hundred or so species of *Veronica*, or koromiko, which are so abundant throughout New Zealand, have a great reputation as a cure for diarrhœa, both among the settlers and the Natives. There is some doubt if the young leaves, which are the part used as a medicine, yield their virtue to the patient by any other means save that obtained through the chewing of the leaves. Dr. Bell (*N.Z. Medical Journal*, April, 1900, p. 135) notes that it is stated that when koromiko is prepared as a tincture or infusion it is not so effectual. Dr. Bell tried large doses of both these preparations without their having the slightest effect on diarrhœa. Neither did he notice any marked astringent effect in a fresh decoction. The leaves themselves are so easily obtained from bush or garden, where they are generally grown as ornamental shrubs, that there would seem to be no reason for making them into a preparation if the mere chewing of the leaves would accomplish the desired result. The leaves of all the species appear to have a similar astringent taste.

MYOPORINEAE.

Myoporum laetum—the ngaio, a common tree throughout New Zealand, especially in coastal situations—is undoubtedly a cattle-poison. Cases of poisoning usually occur in winter, when the grass is short and when branches of the ngaio or the trees themselves are blown down by gales. In the 1900 Annual Report of the Department of Agriculture, p. 127, the writer has recorded that the oil extracted from the leaves (by steam distillation) was non-toxic to guinea-pigs in 6 milligram doses.

The following are instances of poisoning of stock by ngaio which have come under the writer's notice. In May, 1910, the owner of thirty-five cows at Duvauchelle Bay, Banks Peninsula, found fourteen of them staggering about. Two died in twenty-four hours, and three more in another thirty-six hours. The owner opened one and found a dry solid mass of ngaio leaves and twigs in the rumen. The symptoms were compatible with death from acute constipation. A correspondent from Palmerston, Otago, in May, 1911, reported that several cows had died in the district from eating the leaves and fruit of the ngaio, the symptoms being extreme costiveness and severe pain. A typical case occurred in the Wairarapa in August, 1912, where a farmer lost five out of eighteen two- to three-year-old bullocks turned into a 40-acre

paddock about a week previously. The weather had been cold and stormy, and a very large ngaio-tree had been blown down. Three dead cattle were opened, and the small dark-green buds and leaves of the ngaio were found mixed with grass. Mr. Howard, Government Veterinarian, also visited the farm and reported on three of the dead animals, finding the stomachs filled with ngaio leaves, buds, and twigs, mixed with a small amount of dried grass. There is little doubt, he concluded, that the animals were poisoned as a result of eating their fill of ngaio-leaves when there was little or nothing else in their stomachs. Several farmers lost cows through ngaio poisoning at Moumahaki in May, 1918.

Goldie remarks of the use of the ngaio by the Maoris that the bark is chewed for toothache, the twigs and leaves to medicate the vapour bath, and the juice expressed from the leaves is applied to the skin to prevent mosquito and sandfly bites.

An allied species, *M. deserti* A. Cunn., the ellangowan poison-bush of Queensland, has caused, according to Bailey (1906), ("Weeds and Suspected Poisonous Plants of Queensland"), great losses to travelling flocks of sheep. Other species of this genus have been suspected of poisoning sheep.

VERBENACEAE.

Vitex littoralis is the puriri of the northern portion of the North Island, well known as a most useful hardwood tree, valuable for building-construction in which great strength and durability is required, and for fencing, sleepers, &c. Baber remarks that it may be classed among dangerous plants from the severe inflammation which may be caused by splinters penetrating the skin of hands and feet. The dyeing properties of the wood and the dyeing principles have been isolated and investigated by the well-known colour chemist, A. G. Perkin, F.R.S. (*Trans. Chem. Soc.*, 1898, Pt. 1, p. 1019).

PIPERACEAE.

Piper excelsum—the kawakawa of the Maori—is one of the commoner shrubs of the North Island and the northern part of the South Island. It is a plant which possesses, in common with other species of the *Piper* genus (which includes all the trees furnishing the pepper of commerce), the aromatic and stimulating properties which characterize them. The kawakawa of the Polynesian islands, so well known as furnishing an intoxicating drink which is there so ceremoniously consumed, is *Piper methysticum.*

Baber says that the effect of the New Zealand *Piper* is stimulating, exciting the salivary glands, the kidneys, and the bowels slightly. It is aphrodisiac. The fruit and seed, ripe or unripe, are much more powerful than the leaves, although the latter are generally used. An extract of the crushed leaves, made by pouring boiling water upon them and allowing it to cool, affords a pleasant drink when the taste is acquired. The writer has found this decoction an efficient remedy for the cure of boils, and has verified all the symptoms mentioned by Baber as following the use of the extract. Hochstetter remarks that an infusion of the leaves when brewed makes a very refreshing beer. Goldie states that this species does not possess the sedative and narcotic properties of kawakawa. It is used by the Maoris for

toothache, dysentery, and for various other medicinal purposes. Dr. Thompson (" Story of New Zealand ") remarks that it is singular that New-Zealanders have forgotten the art of extracting an intoxicating beverage from kawa-root, seeing that the plant grows abundantly in the country. Lauder Lindsay, in his "Toot" paper, corrects Dr. Thompson in confusing *Piper methysticum* with *P. excelsum*, but quotes Dr. Dieffenbach (1843), (" Travels in New Zealand," Vol. 1, p. 426), in saying that its leaves form a good and apparently healthy substitute for tea. The active principles of both these species are well worth careful investigation.

MONIMIACEAE.

Laurelia Novae Zelandiae—the pukatea, a forest tree—is certainly one of the medicinal plants of New Zealand. Dr. Goldie states that the inner layer of the bark of this aromatic plant is boiled in water by the Maoris, and the decoction thus prepared is applied externally to tuberculous and chronic ulcers and various cutaneous diseases. A strong solution held in the mouth relieves odontalgia (toothache), and it is also taken internally and applied locally in syphilis. The present writer has isolated three alkaloids from the bark (*Trans. Chem. Soc.*, 1910, p. 1381). The physiological action of the principal alkaloid, puketeine, has been investigated by Professor Malcolm, Otago Medical School, who published in the Annual Report of the Department of Agriculture for 1908, p. 226, a short account of his research (which is being continued). The new alkaloid is like strychnine in its action, but very much milder: 0·3 gram per kilo caused convulsions in a rabbit when given by mouth, but the animal recovered; 0·25 gram given hypodermically caused death in a rabbit in half an hour.

The pukatea alkaloids exist in comparatively large quantities in the bark of the tree, amounts of the order of 1 or 2 per cent. of the weight of bark being present. There would therefore be no difficulty in obtaining sufficient of the alkaloid for a thorough investigation. It is noteworthy that two of the alkaloids differ in chemical formula by C_2H_4, puketeine being $C_{17}H_{17}NO_3$, and laureline $C_{19}H_{21}NO_3$. A more recent investigator, Pyman (1914), (*Trans. Chem. Soc.*, Vol. 105, p. 1679), working on an allied tree from Queensland (*Daphnandra micrantha*, family *Monimiaceae*), isolated alkaloids as follows: Daphnandrine, $C_{36}H_{38}N_2O_6$; daphnoline, $C_{34}H_{34}N_2O_6$; micranthine, $C_{36}H_{32}N_2O_6$. The bark of this tree was found to be remarkably rich in total alkaloids, 6 per cent. being found. The physiological action of these alkaloids appears to resemble somewhat the action of puketeine, and when the formula of the daphnandra alkaloids is halved there appears to be some chemical relation between the alkaloids from the two trees. Thus daphnandrine becomes $C_{18}H_{19}NO_3$, daphnoline $C_{17}H_{17}NO_3$, and micranthine $C_{18}H_{16}NO_3$.

THYMELAEACEAE.

Pimelia is a widely spread genus in New Zealand, the commonest species being known in the North Island as the " Strathmore weed " (*P. laevigata*). One or other of the species may be found at all elevations. The common daphne found in many gardens belongs to this family, and has the same poisonous qualities as the *Pimelia*. The bark

of every one of the New Zealand pimelias has the same physiological action when chewed—it produces after a few minutes an intense burning sensation in the mouth. Of the *Daphne mezereum* and *D. laureola,* Long remarks that all parts of these plants are acrid and poisonous, especially the bark and berries. The active principle of the daphne is supposed by Emil Pott to be or be contained in an acrid resin, although a vesicating oil is said by Van Rijn to be present. Drying does not destroy the poisonous property. The symptoms of daphne poisoning are severe purging, burning of the mouth and throat, and in severe cases narcotic effects giving rise to convulsions. Lauder ("Veterinary Toxicology," 1912, p. 259) records poisoning of horses after the consumption of daphne, the symptoms being intense colic, constipation, followed by dysentery and copious evacuation of faeces streaked with mucus, blood, and intestinal epithelium. Post-mortem examination showed stomach and intestines and colon much inflamed.

The symptoms of poisoning by daphne are given fully here in order that those interested in the closely allied pimelias of this country may have better opportunity of detecting poisoning by this plant, which, it is highly probable, has a similar action. In September, 1908, several draught horses died in the Wairarapa district, it was supposed, by poisoning from the *Pimelia* (see *Dominion* of 4th September). Leaflet for Farmers No. 55, issued by this Department, gives an illustration of one of the commonest New Zealand species of *Pimelia*. Experiments in this laboratory have shown that 0·82 gram of resinous dry alcoholic extract of bark was poisonous to a guinea-pig (Annual Report, 1900, p. 127). Bailey records that several of the Queensland species of *Pimelia* are suspected of poisoning stock, particularly sheep. In New Zealand, horses are the only animals which *Pimelia* has been suspected of poisoning, so far as the writer is aware. The recent bark of daphne applied to the skin produces inflammation followed by vesication, and the dried bark is the *Mezerei cortex* of pharmacy, used as a blistering agent or for the making of an irritant ointment. The New Zealand species of *Pimelia* might furnish similar preparations. There are about fifteen New Zealand species, some of them growing to a height of 5 ft., and quite worthy of cultivation in gardens as flowering-shrubs.

LORANTHACEAE.

The family includes those plants which are parasitic on other trees and known as mistletoes. Some of the New Zealand species must be ranked among the most beautiful flowering-plants of the world. From one of the species an infusion has been prepared and used by an Otago medical man as a heart-tonic. The English mistletoe, although belonging to a different genus, had repute as a medicinal plant. The fruit of this is said to be poisonous.

EUPHORBIACEAE.

In *Euphorbia glauca*, common on many New Zealand seashores, there is one representative of the poisonous *Euphorbia* genus. Suspicion should be attached to the New Zealand species on account of the poisonous nature of many of its allies, some of which are growing wild as naturalized plants in this country.

URTICACEAE.

This family includes the genus *Urtica*, containing the nettles, of which the only dangerous one is *Urtica ferox*, the ongaonga of the Maori or tree-nettle of the settler, common throughout New Zealand. Instances of dogs and horses having been poisoned by coming into contact with this species are given in the Chemistry Division's annual report for 1909 (Annual Report of Department of Agriculture, p. 180). The Australian *U. gigas* is reported frequently to kill horses, and apparently the ongaonga will do likewise if the horse is badly enough stung.

LILIACEAE.

Dianella intermedia, the turutu of the Maori, usually found growing under manuka scrub, is a tufted grass-like plant with very conspicuously beautiful fruits abundantly produced in autumn. In the *N.Z. Medical Journal* for April, 1891, Dr. Ernest Roberton, of Auckland, gave an account of the poisoning and death of a child, aged one year and nine months, in about eighteen hours after eating a number of berries of this plant. There were no convulsions or twitchings at any time except hiccough and laboured respiration, which were prominent symptoms at the last. No post-mortem was made. Suspicion has again been directed to this plant by a note in the *N.S.W. Agricultural Gazette* of November, 1908, by Mr. Maiden, Government Botanist. Several valuable pigs and some suckers which were just beginning to pick about died after eating the roots of a species of *Dianella*. Dragendorff mentions *D. nemorosa* and *D. ensifolia* as medicinal plants, and states that the roots were used in dysuria and other complaints. The former species is used in the Straits Settlements as a rat-poison.

Phormium spp., the well-known New Zealand flax, was, according to Goldie and others, used by the Maoris as a cathartic, the root or portion near the root being the part of the plant used. Dr. E. W. Bell also has an interesting account of its uses in a paper, "Medical Notes on New Zealand" (*N.Z. Medical Journal*, April, 1890, p. 135). Dr. F. A. Monckton, in the *Australian Medical Gazette*, bears witness to the efficacy of a strong decoction of the roots and butts of the leaves. He writes: "Somewhere about the year 1869–70 a letter appeared in the Melbourne *Argus*, signed by myself as Provincial Surgeon of Southland, bearing witness to the extraordinary healing properties of *Phormium tenax*, commonly known as New Zealand flax. From that time to the present I have used it in hundreds of cases, including lacerations and amputations of every description, and I have no hesitation in saying that there is nothing known in the Old Country that can equal it in producing healthy granulations. I use a strong decoction—the stronger the better—made from the roots and the butts of the leaves boiled for twelve hours. At one time I had to make it fresh every second day, as it readily ferments and deteriorates, but since carbolic acid came into vogue I keep it for any length of time by adding about an ounce of equal parts of carbolic acid and glycerine to every quart. I require no other antiseptic precautions, but simply syringe the lesions occasionally with it, and maintain cotton wool and lint soaked in it constantly to the parts affected. If there are no foreign matters to be discharged there will be no discharge." The doctor gives details of two very bad cases of shattered and torn limbs

which had been treated by him with perfect results by means of fresh flax decoction and nothing else. He concludes: "I might adduce proofs by scores of its efficacy, but if owing to these facts being made prominently known medical men can be induced to test the remedy for themselves, it will require no assertion from me to cause *Phormium tenax* to take the premier place as a granulating agent."

Sir A. H. Church (1873) investigated the chemistry of *Phormium tenax*, and isolated a bitter principle which he considered a tonic (*Trans. N.Z. Inst.*, Vol. 6, p. 260). Students of phormium would do well to consult the extensive bibliography prepared by Dr. B. D. Cross (1914) attached to a paper, "Investigations on Phormium" (*Trans. N.Z. Inst.*, Vol. 47, p. 61). The bibliography was not published, but is filed for reference in the Dominion Museum Library.

THE DEVELOPMENT AND FUTURE OF ELECTRIC MILKING IN NEW ZEALAND.

LAURENCE BIRKS, B.Sc., M.Inst.C.E., &c., Chief Electrical Engineer, Public Works Department, in the *New Zealand Journal of Science and Technology*.

FOLLOWING an article by the author on electric power for milking, in Volume 4 of the *Journal*,* it is of interest to note the present position of this development, which promised and still promises to grow to such large dimensions, though naturally the drop in prices of agricultural products generally has delayed the extension. The returns show that there are already over a thousand milking plants operated electrically in the Dominion from public electric-supply systems in addition to those operated from private electrical installations, and the number is increasing rapidly.

In Canterbury electric power is as yet generally available in only three farming districts, and the numbers of electrically operated milking plants in these districts are—Tai Tapu district, 36; Eyre County, 4; Rangiora County, 32; the charge being £21 per year per 3 h.p. motor.

The supply will be available this season in the Banks Peninsula, Ellesmere, and Kowai Electric-power Districts, and it is anticipated that the season will open with about fifty milking plants in each district. The charge in these districts will be £6 per horse-power per year, plus a unit charge of 3d. for the first 80 units per month, 2d. for the next 120 units per month, and 1½d. for all over 200 units per month.

In the Hawera Electric Supply Company's area there are fifty milking plants operated electrically. The charge is by meter at the rate of 4½d. per unit, less 10 per cent., and the consumption and annual cost for four typical milking plants for last season were as follows:—

Farm.	Number of Cows.	Total Units.	Annual Cost.
			£ s. d.
A	75	1,801	30 8 3
B	50	1,001	17 6 10
C	34	706	12 16 0
D	28	502	8 16 0

* Reprinted in the *N.Z. Journal of Agriculture* for August, 1921.

Monthly Demand (Units).

Farm.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.
A ..	159	252	148	212	242	188	192	250	132	26	..	..
B ..	90	144	100	115	120	104	115	141	72	..	..	..
C ..	63	73	108	69	123	90	96	84	..	..	..	..
D ..	51	81	51	69	81	57	57	75	..	..	..	..

These figures correspond fairly closely to those given in the previous article for the Canterbury examples—viz., 1,244, 922, 675, and 1,919 units per year—and the distribution over the year is practically the same. They work out at 0·38d. to 0·49d. per pound of butterfat.

The reduction of demand for the midwinter months is, of course, particularly advantageous to the electric-supply authority in that it permits of the sale of the power elsewhere at the time when the demand for lighting and heating is the greatest, thus improving the load-factor.

In the Stratford Borough area eight plants are operated electrically, the charge being 4d. per unit, with a maximum of £15 per year.

The Murchison County has just installed a 100 h.p. automatic generating plant, using an old gold-mining water-race, and has run nine miles of reticulation, to which four milking plants are already connected.

In spite of the recent depression in butter-prices, the conversion of the milking plants in the Waikato district to electric drive is proceeding rapidly. The distribution in the farming districts of the power from the Government plant at Horahora Rapids is in the hands of four Electric-power Boards—viz., Thames, Te Awamutu, Central, and Cambridge. Supply was commenced in Thames and Cambridge districts early in 1921, but in Te Awamutu and Central it was practically into the opening of the milking season before supply was generally available, and, as a result, the conversion of the majority of the milking plants was postponed until the coming season. In spite of this the proportion is very substantial, as set out in the following table :—

—	Thames.	Te Awamutu.	Central.	Cambridge.
Supply commenced..	11/3/21	26/8/21	13/7/21	28/4/21
Number of milking plants in whole district	2,000	850	600	200
Number within reach of the mains ..	900	700	330	250
Number already converted or being converted to electric drive	450	150	250	100

[NOTE.—This table is brought up to 6th March, 1923.]

The rates for energy in Thames Valley are £21 per year up to 7,000 lb. of butterfat produced, plus ⅓d. per pound of butterfat in excess of 7,000 lb. This works out at about ¾d. per pound of butterfat for a herd of thirty-five cows producing 7,000 lb. of butterfat per year, and proportionately higher for a smaller herd and cheaper for a larger herd, down to 0·48d. per pound for a herd of a hundred cows of good

average yield. In the Te Awamutu district the rate is £6 per year per horse-power of connected load (usually 2 h.p.), plus a unit rate by meter of 3d. for the first 80 units per month, 2d. for the next 120 units per month, and 1½d. per unit for all over 200 units per month. In the Central and Cambridge districts the rates are practically the same.

In the Te Awamutu district the following are a few representative costs at the above rates:—

Number of Cows.	Horse-power.	Cost of Electricity for Year.
		£ s. d.
18	1	15 18 6
29	2	19 1 9
90	2	33 2 3
102	2	28 19 0

These include the highest and lowest charges in this district, the balance ranging between £20 and £30. They range in cost per pound of butterfat from ½d. in the large herds up to 1d. in the smallest herd.

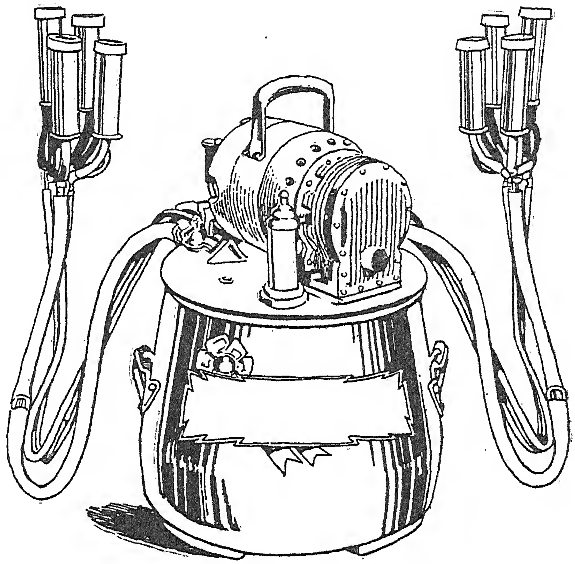
The competing source of power for milking purposes is benzine at £1 1s. to £1 10s. per case, according to the distance of cartage from the railway-station, the consumption usually ranging from twenty to fifty cases per year. The electric power thus has no difficulty in competing on the score of cost of fuel alone, apart from the lower cost of maintenance, lower first cost, and the great advantages of reliability, simplicity, and ease of operation of the electric motor as compared with the oil-engine.

The number of electrically operated milking plants is much less than it would otherwise have been, owing to the drop in the price of butterfat rendering the financing difficult to many dairy-farmers. The Thames Valley Board had met this position from the start by financing the farmers and undertaking the work of installing the electrical system, and hence the large proportion in its district. The Te Awamutu and the other Boards are now making arrangements to advance the cost of the installation on time payments, and, as a result, the proportion of electrically operated milking plants in these districts will probably be as large next season as in the Thames Valley.

As a further method of cheapening the cost of installation, the Boards are arranging, where practicable, to call comprehensive tenders for the whole of the wiring and installation of motors for groups of farms up to fifteen within a given district simultaneously. As a result of the arrangement, applications for electric supply are being received so fast in some districts that it is difficult to deal with them all. Moreover, owing to the saving in transport expenses on the part of the wiring contractors, the cost of the installation is materially reduced by this grouping of the work of installation.

In addition to those districts in which the supply is already available, the reticulation is being erected in several other districts, particularly in the Southland, Manawatu, Rangitikei, Horowhenua, Wairarapa, Opunake, and Kaponga districts, where the necessary plant is being installed, which will involve a large increase in the number of electric milking plants in operation within a couple of years.

The history of the development of electric-power milking has been the replacement of the standard 3 h.p. oil-engine driving the ordinary releaser milking-machines by, first, a 3 h.p. electric motor. This was found to be largely in excess of the power actually required, and that even 1 h.p. will operate sufficient milking-machines at once to deal with a herd of a hundred cows. But a large proportion of the herds range from ten to twenty cows, and for a herd of this size a plant capable of milking two cows at a time is all that is required. A machine is now available of a much more compact type, capable of fulfilling this service, and driven by a motor of only ¼ h.p. Moreover, it has the great advantage that the motor vacuum - pump and releaser are all mounted direct on the lid of the bucket, and the whole outfit is thus exceedingly portable, and can be carried about in one hand, thus reducing the cost of the building and accessory equipment required in connection with it to a minimum. The complete apparatus is shown in the figure herewith. The cost of operation will also be much less than the standard 1 h.p. or 2 h.p. plants, though, of course, with the self-contained plant the separator and water-supply pump, if required, cannot be driven from the same shaft as is usual with the larger installations, and separate motors will have to be installed for this purpose. The Thames Valley Power Board have fixed a charge ranging from £7 per year upwards for the energy for this ¼ h.p. outfit. Though it will probably not take the place of the standard arrangement for large herds of thirty to one hundred head, the ¼ h.p. unit will probably have a large influence in extending the demand for electric power for milking the smaller herds of the Dominion.



Areas in Orchards, Gardens, Tree-plantations, &c. — Particulars of the area in occupation in New Zealand under this class in 1921–22 (aggregated as 146,346 acres on page 123 of February *Journal*) are as follows: Commercial orchards—Bearing, 17,607 acres; not bearing, 7,604 acres. Orchards for private use only, 5,910 acres. Vineyards, 179 acres. Market-gardens, 4,262 acres. Nurseries and seed-gardens, 395 acres. Private gardens and grounds about residences, 57,927 acres. Plantations, 52,462 acres.

SLAUGHTERING OF STOCK.

WHICH IS THE MOST HUMANE METHOD?

Paper read by Major WILMOT C. QUINNELL, M.R.C.V.S., M.R.S.I., at the meeting of the Australasian Association for the Advancement of Science, Wellington (N.Z.), January, 1923.

WHEN Dr. Reakes, Director-General of the New Zealand Department of Agriculture, did me the honour of inviting me to present some paper for discussion at this meeting of the Veterinary Section of the Australasian Association for the Advancement of Science it appeared to me that the subject indicated in the title would be an appropriate one to submit at this juncture, for the following reasons :—

Firstly, as far as I have been able to ascertain, the technique of slaughtering stock for food has not been discussed by any previous gathering of professional men, although articles bearing on the matter have appeared from time to time in the New Zealand Press. Secondly, owing to the existing Government veterinary inspection of meat at all abattoirs and meat-works throughout the Australian States and New Zealand, I may safely remark that all we veterinarians at this meeting have at some time or other been employed in this highly important branch of the meat industry. Thirdly, it is a subject of some moment in England at the present time, as will be seen from the report published in the *Veterinary Record* of the 9th September, 1922, of the deliberations of the annual meeting of the National Veterinary Medical Association, held in the Guildhall, Bath, on the 2nd August, 1922, at which the following resolution was agreed to :—

> As there is a great diversity of opinion on the question of the humane slaughtering of animals intended for human food, and the subsequent effect on the flesh of the various methods used, we suggest that a Government Committee of inquiry be instituted to investigate the whole subject; the Committee to consist of members of all professions and trades interested.

During that discussion General Sir L. Blenkinsop read an extract from a letter to the *Daily Mail* by the secretary of the Association of London Retail Meat Traders, as follows :—

> With regard to the mechanical killer, the meat trade takes up this strong and unanswerable position—namely, that an inquiry must be held by the Government into the whole question of the use of mechanical implements in slaughtering. All reliable scientific opinion is, however, on the side of the pole-axe for slaughtering animals intended for food, and there is also ample evidence, from the men's point of view, that they consider the mechanical slaughtering implement to be dangerous.

It is apparent from these extracts that what is sought is the most humane method of killing stock at slaughtering-establishments. In the word " humane " we understand to be implied an active endeavour to discover and relieve animal-suffering, and especially to prevent it. As the world advanced in civilization, and social and humane instincts developed, the subject of animal rights and cruelty to dumb animals has attracted the attention of thinkers from earliest times. One of the maxims of the Buddhist and Pythagorean canons was " not to kill or injure any innocent animal." The rights of animals now are

subordinate to almost anything that can be construed into a human "want" or consideration, including flesh-eating, fur- and feather-wearing, hunting, and scientific research to save man from disease or prolong life.

The thought of pain among dumb creatures distresses many minds, but there is every reason to believe that pain among animals is less acute than in human beings. In order to live, man must kill, but in doing so his methods should be as merciful as those shown by animals that live upon other living creatures. To illustrate this I take the following extract from a most admirable article by a natural historian, Ernest Bryant, in *My Magazine* :—

There comes to the memory, as we run the mind's eye over the flesh-eaters and preying animals, not so much a thrill of horror at their deeds, but a sense of wonder at their efficiency and unerring skill in causing swift, sudden, painless death. It is one of the most astonishing things in the world that dumb brutes show as sure an instinct for an instant, fatal blow as if they had studied anatomy at one of our hospitals. A stoat knows exactly how to inflict instantaneous death upon a rabbit or a hare. An eagle or a raven goes as surely to the right spot for attack upon a fallen deer or weakening sheep as a fox goes to the fatal spot in a domestic fowl; and a humble spider, spinning her silken web in our garden, is unerring in her death-stroke as a cheetah that fastens its teeth in the straining throat of a buck. Whether the wound is made with sledge-hammer paws and vice-like jaws, or with the poison fang and stiletto of the insect, the end is almost certain of terrible but painless suddenness. Now, there is mercy in this. There is no conscious pity in a tiger, but it is so extraordinarily fitted to its volcanic outbursts of power that it kills too soon to hurt. It has such strength that it might hold its victim by means of its grapnel-like claws and munch it alive, but, as a rule, it instantly kills. A python has such appalling force that it could swallow its prey alive, but, throwing itself like a cowboy's lasso around the body, it gives one convulsive strain, then crunch, crack, and life is in a second squeezed from the victim's body. These things have been and must be. We find the lower world as devoid of mercy in intent as it is among cannibal human beings, and it shocks and stuns a civilized mind. But as these things must be, then it is consoling to believe that death comes to the victims with such a rush of expert art as to be painless, or at worst only the overpowering agony of a fleeting second. Thus, in so refining the implements of destruction in the slayers, in so incredibly perfecting the instinct for the right blow at the right place at the right moment, Nature is kind in her seeming cruelty.

MATTERS RELATING TO KILLING.

Before entering upon the question of various methods of slaughter it is essential to give a few introductory and explanatory notes on certain matters relating to killing, and thus avoid repetition when each system is brought under review.

Operation of Bleeding.—This is carried out by the opening of the (*a*) throat or cervical blood-vessels, or (*b*) chest or the anterior thoracic blood-vessels, its completeness depending on the following conditions: In all methods involving the destruction or injury of the brain there is danger of defective bleeding, as is the case with shooting, pole-axing, pithing with a spear—the animal drops in convulsions. The practice of "fidging"—using a cane 3 ft. long and thrusting it through the hole made by the pole-axe or through the incision made at the nape of the neck—by the action it produces on the body, breaking up nerve influences to blood-vessels, hinders blood-flow, and bleeding is incomplete. Animals whose heart receives a wound with the sticking-knife, termed "overstuck," will not bleed completely. With fatigue, excitement, or overheating (thermic fever), bleeding is incomplete. In bleeding, the

posture of the animal is a matter of some importance; the recumbent position is associated with diminished force of the circulation, and should therefore be avoided.

Speaking generally, the blood constitutes about one-twelfth of the total weight of the body. The amount of blood drawn at the time of sticking varies with the size, age, and accuracy of sticking, with the condition of the animal, and the length of time that has elapsed since it has taken food and drink. The quantity of blood, roughly speaking, may be put down as: In a young animal, eighteen months old, about 2½ to 3 gallons; in a three-year-old bullock, about 4 gallons; and in aged milking-cows, sometimes 4½ to 5 gallons. The rate of movement of the blood through the arteries is estimated to be about 1 ft. 8 in. per second, and through the capillaries at about 1 in. per minute.

Effects of Struggling or Convulsions.—Liebig, in his "Letter on Chemistry," mentions the case in which the flesh of a roebuck, which had struggled after having been caught in a snare, gave rise to symptoms of poisoning. According to Gautier, pigs have been fatally poisoned through being fed upon the flesh of a horse which had died during its struggles when being broken in; and, like Liebig, he has known of cases of human poisoning by the flesh of roebucks which had been in a state of terror or exhaustion. From these and many other cases that could be cited there can be little doubt that harmful physiological alkaloids are elaborated by cells of living animals, through undue violent movements of the muscular system during the process of slaughter, as in the cases of (*a*) roping and throwing a bullock preparatory to killing, and its striving to get free; (*b*) the use of the pole-axe and bullet-firing appliances, when the animal drops in convulsions; (*c*) the unnecessary practice of fidging, producing violent spasms of the muscular system; (*d*) the struggles of death — namely, the convulsions which declare themselves as a prelude to death. All these conditions may be avoided or minimized by causing concussion of the brain.

Reflex Action, Movement, or Motion.—In physiology this means those comparatively simple actions of the nervous system in which a stimulus is transmitted along sensory nerves to a nerve-centre, from which again it is reflected along efferent nerves to call into play some muscular, glandular, or other activity. The actions are performed involuntarily and often unconsciously, as is the contraction of the pupil of the eye when exposed to strong light.

Cadaveric Rigidity, "Setting," or Rigor Mortis.—This condition is the characteristic stiffening of the body caused by the contraction of the muscles after death. It comes on more or less speedily according to temperature or climate, and also after death under different methods of slaughter—both of which circumstances also influence its intensity and duration. It is retarded by cold, but in very hot weather the rigor is slight and brief, or may hardly be appreciable. The relaxation of the carcase as the rigor passes off is one of the earliest signs of incipient decomposition.

These phases of the subject are of some importance in considering the merits and demerits of various methods of slaughter, when reference is made to "duration of bleeding," "duration of reflex," "amount of blood," and "keeping-qualities of meat."

METHODS OF SLAUGHTERING.

(1.) Pole-axing, followed by Bleeding.

This is the usual method of slaughtering cattle in England. The implement of knocking-down is a bull-head axe or pole-axe, a weapon or tool consisting of an axe-head on a long handle, combined with a blade like a pick or punch. After the animal is secured by being tied with a rope round the neck to a ring in the wall or floor, the slaughterman strikes it on the forehead with the pole-axe, the punch end of which crashes through the frontal bone into the brain-case, mutilating the brain-substance. On the beast falling to the ground it is immediately pithed, after which the fidging-cane is thrust through the incision at the nape of the neck and vigorously worked about until the limb-movements cease. The butcher then sticks the beast by severing the anterior thoracic vessels, when the life-blood gushes out. The average duration of bleeding is about two to three minutes.

Similar disadvantages apply to this method of slaughter, but in somewhat lesser degree, as are found in the use of mechanical killers that cause mutilation to the brain and, together with the practice of fidging, bring about a condition hindering complete bleeding of the carcase. Again, the operations of pole-axing and bleeding are carried out on the same floor; the recumbent position of the body on the floor does not facilitate accurate sticking, as it at times causes the unsightly condition termed "bodying" (blood-effusion under the membrane lining the chest-cavity).

(2.) Pithing or Spearing, followed by Bleeding.

This is the usual method in vogue throughout the slaughterhouses and meat-works of Australasia. The instrument is a spear, consisting of a long pole with a chisel-shaped steel attachment at one end of it. The butcher stands on a plank in the pithing-pen, just above the head of the animal, and thrusts his spear-end into the space or hollow at the base of the skull, dividing or injuring the spinal cord at its junction with the brain. The animal immediately drops. The slaughterman enters the pen and completes the pithing operation by a stab with a sharp-pointed knife in the occipital region. The animal is then pulled out of the pithing-pen on to the dressing-floor, where the fidging-cane comes into operation, after which it is bled, being stuck in the thoracic region.

A very important objection to this mode of killing is that on the animal being stabbed with the spear it drops in convulsions, in many cases lasting a considerable time, depending on the degree of injury to the spinal cord. Apart from the actual system, it is the practice in some slaughtering establishments to run a number of cattle into the pithing-pen at one time, so that the killing of one is done within the sight of the others, which causes them much unnecessary suffering while waiting their turn. Further, the use of the spear or pither must be in skilled hands. Sometimes even an efficient operator misses the vital spot; in such cases the animal becomes infuriated, and the slaughterman may lose his temper, with the result that his poor victim receives many stabs before it is finally despatched. Pithed or speared animals do not seem to bleed so well; spearing causes the retention of much blood

in and around the neck region, giving rise to a condition of "dirty neck," which becomes more noticeable and detracts from the appearance of frozen fore quarters on their being thawed for sale.

(3.) Direct Bleeding, Cervical or Thoracic, without Stunning or Shooting.

This is the common method of slaughtering sheep, and, in some places, calves and pigs. It is also practised by the Jews, Mohammedans, and races of a number of other countries for the slaughter of all animals intended for food.

Sheep: The animal is cast on its side on a wood grating, and is held firmly by the slaughterman placing the weight of his knee on the sheep's shoulder. He grasps the chin with his left hand, at the same time bending its head back to extreme tightness. The knife is then sharply run across the throat, severing the windpipe and the principal blood-vessels and the spinal cord as well, as he forcibly dislocates the neck of the animal. The sheep bleeds into a special blood-drain for collection, while the sliding-door of the waiting-pen is pulled down on the body, which holds it fast during the death-struggles.

Calves: These animals are usually hung up by the hind legs, and sometimes they are stunned by a blow on the head with an axe-head; in other cases they are pithed with a knife-stab at the nape of the neck; in yet other cases they are bled without previous stunning or pithing.

Pigs: The method of slaughtering pigs at bacon-factories and abattoirs consists in the animal being hoisted by means of a chain (which in turn is attached to the drum of a windlass worked by hand) by one of the hind legs to an overhead bar. The moment it reaches this bar the slaughterman sticks the pig with a sharp narrow-bladed knife, severing the anterior thoracic vessels.

In reference to sheep and calves, the method of slaughter—direct bleeding—is quite effective in despatching these smaller animals expeditiously and painlessly, and with no detrimental effect to the meat or market value of heads, brains, or tongues. In reference to slaughtering pigs, it would be a great advantage and more humane if the pigs were stunned by a mallet immediately they are hauled on to the rail; it would stop their horrible squeaking, the swaying of their bodies, and the paddling action of the fore feet, all of which are disconcerting to the sticking operator.

The Jewish Method of Slaughtering Cattle.—The beast being brought into the slaughterhouse, a rope with a slip-noose is placed round its neck, and is fastened to a ring fixed to a post close to the flooring, when it is made taut, the head being thus brought close to the ring; a second noose of chain is passed round the hock or hind shank, and is drawn sharply to cause the creature to fall or to be cast down easily by the attendants on its side. The leg-fastening having been firmly secured, the head is twisted back to extreme tightness. The Jewish skilled operator then appears, and, with a knife the blade of which is about 15 in. to 16 in. in length and sharp as a finely set razor, cuts the neck through to the spinal column by drawing the knife swiftly and smartly across. The time from cutting the throat to the last throes of the dying beast, as a rule, is four minutes. It is claimed by Dr. Dembo, from a series of tests made by him, that in the case of

animals killed by direct bleeding (the Jewish method) one hour and ten minutes elapsed between killing and onset of rigor mortis, and in the pole-axe method two hours and thirty-five minutes. Hence the progress of putrefaction is much less rapid in Kosher meat than in meat slaughtered by the pole-axe.

The law of England makes special allowance for the Jewish mode of slaughter. The method is essentially a humane one, as in the sheep insensibility at once supervenes; but the fact of other subjects being much larger, and the cutting of the throat crosswise, causes the blood to gush and spout in all directions, rendering this detail horribly repulsive. Further, it has been noticed that the butchers have occasion to sever these cervical blood-vessels again, consequent on their swelling and becoming partially closed, with the object of hastening the flow of blood. I fail to see why the Jews do not adopt stunning with the hammer preparatory to bleeding, thus dispensing with the process of roping and casting of the beast, and the unnecessary excitement, terror, and struggling of the animal on being under restraint for killing. Again, the Mosaic law is very strict regarding the killing of animals for food, and its ordinances are such as to secure to the fullest extent the removal of the blood from the carcase. This object would be far better accomplished by stunning with the hammer, as will be discussed later.

(4.) Shooting followed by Bleeding.

The first improvement on the ordinary pole-axe was a mechanical killer invented in Germany and known as the slaughter-mask. The apparatus consists of a leather mask with a metal-plate attachment containing a hole into which a hollow-ended bolt is placed. The mask is adjusted over the forehead of the beast, and then the bolt is tapped with a mallet, driving it through the cranium into the brain. The animal is then pithed with a knife and bled. Since this invention many instruments—bolt-striking and bullet-firing—have been designed on similar lines, such as the Kleinschmidt spring-bolt apparatus, Cash's and Behr's pistols, the Siegmund shooting-mask, Stachl's shooting-apparatus, the Speary killer, Stoff's Swedish and Greener's Safti killer, and latterly the R.S.P.C.A humane killer and the R.S.P.C.A. slaughtering-pistol.

From personal experience, and from information on the subject gathered from reports on the scientific tests and demonstrations made, I have learned sufficient to prove that this method of shooting has no advantage over the ordinary modes of slaughter in daily use at slaughtering-establishments, but, on the contrary, has shown the following disadvantages in its employment: There is a certain amount of danger in the use of these bullet-firing instruments. The shooting does not appear to be as humane as the ordinary methods in daily use, as animals are not always rendered unconscious, and there is no reduction in the duration of the reflex action. Animals do not bleed so readily and completely, therefore the keeping-qualities of meat are affected. In the case of pigs and sheep, the heads and brains have their market value reduced.

(5.) Stunning followed by Bleeding.

This is the method adopted for cattle in the slaughtering-establishments in America. The implement used for the purpose of stunning is a large sledge-like hammer, which should not be less than 6 lb. or

7 lb. in weight. The body of the hammer-head should be of even circumference, short and straight, with both ends slightly convex. The animals are driven one at a time into a specially constructed narrow pen, having a platform on top, on which the operator stands. On entering the pen the animal's attention is attracted to the small opening in the front partition, and while peering through this the blow is dealt, the slaughterman dropping the beast with one blow of the hammer high up on the forehead. One of the side partitions then slides up, and the stunned animal is automatically thrown out to the dressing-floor. The butcher immediately places a leg-chain around one of the hind fetlocks, the chain is hooked on the hoist-chain, and the animal is hoisted by means of the driving-shaft, which in turn is worked by a dynamo in the slaughterhouse. The stunned animal is thus placed on an overhead bar, and is pushed along the track-bar to the grating over the bleeding-pit. With the animal thus suspended it will be apparent that the butcher can stick more expeditiously and with greater accuracy than with the beast lying on the floor; and, further, there is no soiling of the hide with blood. Bleeding is carried out by opening the large anterior thoracic vessels, and the animal being suspended by the hind leg ensures rapid and complete drainage of the carcase of its blood contents.

The effect of a stroke or blow from such a hammer as described is concussion of the brain—namely, a shock to the brain from injury, but without visible effect on its substance, thus differing from contusion as produced by the pole-axe or humane killers, where the brain-substance is more or less lacerated and accompanied with varied degrees of consciousness. Although the brain is the seat of emotion, reason, and sensation, it is of itself non-sensitive, as portion of it may be cut away with little or no effect. An animal deprived of the cerebrum or forebrain retains the special senses of sight, sound, taste, &c., but the intellectual faculties are lost. In concussion there is a period of collapse ; the animal lies stunned and motionless, with breathing slow and heavy—a desirable condition. The felled beast is now in a complete state of anathesia, or, pathologically speaking, analgesia—the incapacity of feeling pain in a part, although the tactile sense may be more or less preserved. Under these circumstances the operation of sticking must be absolutely painless. The quivering or twinge movement noticed on the butcher cutting off an elliptical section of the skin of the neck preparatory to the act of sticking the animal is only a tactile reflex—a reflex movement due to stimulation or irritation of nerves of touch. Therefore this sudden momentary twinge following on the butcher's incision of the skin does not denote pain as many are led to believe.

So, under this system of hammer and knife we obtain all that can be desired in slaughtering stock for food. Pain is avoided ; bleeding is thorough, with no detrimental effect to the meat ; and the operator requires little or no training. As far back as 1897 I recognized the need of more humanity in the slaughtering of animals for food, when Queensland was the first colony in Australasia to pass an Act of Parliament for the veterinary inspection of meat intended for export, and I had the honour of being appointed to administer that Act. Spearing or pithing was in general practice in those days, and I witnessed some

revolting and brutal exhibitions from the misuse of the spear or pither on stock that happened to be extra wild, or with those unfortunates comprising the tail-end of a big day's killing, when the operator was exhausted from work and heat. It was through seeing such sights that I advocated the American method, and was instrumental in getting it first adopted in the largest slaughtering-establishment, the Queensland Meat-export Company's Works at Brisbane, where they put through three hundred to four hundred cattle daily. The method was highly commended, and proved satisfactory in every way. Then, coming to New Zealand and taking service under the Government, I was posted in 1905 to the Wellington Meat-export Company's works for duty, and, as a new slaughterhouse was under construction, I recommended the then manager, the late Mr. Dilnot Sladden, to adopt the hammer-and-knife system of slaughter. This was done, and proved itself far preferable in every way to the old mode of spearing and pithing.

CONCLUSION.

Finally, after the experience of life's practical knowledge relating to this subject, gained not only in Australia and New Zealand, but in England, Scotland, and France during the period of five years from 1915 to 1920, I state my opinion that there is no method so far devised which is more efficient in causing swift, sudden, painless death than the employment of the hammer and knife. It should one day become the universal method of slaughtering stock for food.

COW-TESTING ASSOCIATION NOTES.

W. M. SINGLETON, Director of the Dairy Division.

IN the January number of the *Journal* interim statistics were given regarding the number of dairy cows under association test in the Dominion. We are now in a position to complete the figures. It is calculated that this season there are some 78,756 cows whose yields are being systematically authenticated. This number, compared with last season, represents an increase of 33,192, or 72 per cent., which must be accepted as very tangible evidence of the rapidly increasing appreciation of the value of this work.

Keeping in mind the total just mentioned, it is interesting to trace the figures from year to year since, in 1909–10, the first cow-testing association in New Zealand, comprising 815 cows, was organized by the Department and conducted at Dalefield, in the Carterton district. The following year there were four associations, testing 4,317 cows, which the next season increased to eleven associations with 13,440 cows; a season later (1912–13) showed 25,000 cows. Then came the war period, bringing its labour and other difficulties, which naturally retarded the progress of the work under review. Taking up the figures at the conclusion of the war, 25,200 cows were calculated to be on association test during 1919–20, 35,757 in 1920–21, 45,564 in 1921–22, and, as previously stated, 78,756 for the current season. The latter number of cows is included in 135 associations.

While the present total, standing alone, appears large, and is undoubtedly praiseworthy, it must not be overlooked that it represents only 7 per cent. of the total number of dairy cows in New Zealand, and very much more remains to be done before the position can be regarded as really satisfactory.

Under present economic conditions it is only by keeping the better class of cow that a reasonable financial return can be expected, and this in turn resolves itself into the fact that testing must gradually but surely make itself essential. The new herd will be classified only through the systematic use of the Babcock tester, and when the poorer producers have been culled and the better dairy cows mated with proven sires, testing will again be needed among the young heifers as they come to profit. Thus some day our farmers may look forward to the general testing of dairy cows by the association method in New Zealand. In so young a country, with many unbroken or only partly broken dairy farms and a large percentage of scrub cows and bulls, progress along this line comes slowly, but that it is surely coming will be apparent from the figures quoted.

AN EXAMPLE OF HERD-IMPROVEMENT.

The cow-testing returns which pass through this office afford many examples of herd-improvement, and it is proposed from time to time to place some of the more interesting cases before *Journal* readers. The following table indicates the average seasonal production of a herd which has been tested each season since the association of which the owner is a member was formed in 1910–11:—

Year.	Number of Cows in Herd.	Average Days in Milk.	Average Yield of Butterfat.	Association Average Yield of Butterfat.
			lb.	lb.
1910–11	26	..	183·00	222·02
1911–12	31	..	211·24	233·59
1912–13	27	244	234·04	235·72
1913–14	27	..	278·06	264·00
1914–15	24	249	246·68	233·65
1915–16	26	266	289·71	283·36
1916–17	27	276	282·73	267·07
1917–18	28	274	296·64	296·26
1918–19	26	288	349·57	266·25
1919–20	29	280	336·00	230·47
1920–21	26	268	285·24	209·03
1921–22	27	277	354·73	275·19

From these figures it will be seen that in twelve years the owner increased his herd average, with practically the same number of cows, from 183 lb. to 354·73 lb. butterfat per cow—an increase of 171·73 lb. Unfortunately, figures showing the average days in milk for the first, second, and fourth testing seasons were not compiled. It will be noted, though, that from 1912–13 to 1921–22 the average lactation period per cow rose some thirty-four days.

In the writer's opinion the average lactation period in New Zealand is too short. To obtain a maximum of production it is obvious that the milking-period must be increased, leaving a smaller

portion of the year during which the animal is not earning her keep. The period could reasonably be increased to ten months, and still leave ample rest both for the cow and the milker. Only by proving the cow with the staying-power, and breeding from her, can this end be attained. It is here that the certificate-of-record testing of purebred dairy cows plays an important part, as it indicates bulls from cows of proven yield and proven ability to yield profitably for a full year.

To revert to the table, it may be mentioned that the owner of the herd commenced using a purebred sire during the 1914–15 season, and it is apparent from the later figures that this animal's influence for improvement duly exerted itself. During 1917–18 the owner milked five heifers of his own breeding, and these had an average yield of 258 lb. butterfat.

For purposes of comparison a column has been included showing the association average for each season. The figures also reveal the fact that the seasons 1914–15 and 1920–21 were unfavourable generally, as not only was the herd average down, but the association average also showed a marked drop from the previous season.

It will be seen that this member's original herd, yielding an average of 183 lb. butterfat, was undoubtedly an ordinary herd, and that its yield was some 39·02 lb. below the association average. The association comprised twenty-four herds, in which the one in question stood fifth from the bottom. In 1921–22 his average herd-yield of 354·73 lb. butterfat exceeded the association average by 69·34 lb., and the association included thirty-six herds. He was then fifth from the top, and all the herds (excepting one) with higher average yield had fewer cows.

To sum up, and to put the case into money: For purposes of calculation it will be reasonable to assume an average price per pound of butterfat of 1s. 6d. Had the owner commenced in 1910–11 with a herd equal in yield to his 1921–22 herd, he would have had 171·73 lb. of butterfat more per cow, which at 1s. 6d. per pound means (in near figures) £12 17s. 6d. per cow, or, on a twenty-six-cow herd, £334 15s. Had the production of the herd remained unvaried at the highest figure for the twelve years he has been testing, it would have meant £4,017 more in his pocket.

These figures need no further comment—they speak for themselves. And the standard which the herd under notice has now reached is by no means an abnormal one, but one well within the reach of many. This basic method of making the dairy business pay is no secret, but should be clear to all thoughtful dairy-farmers. It lies (1) in the systematic and continued use of the Babcock tester per medium of the cow-testing association; (2) in the selection of the right foundation animals from which to breed; (3) in the use of a proven sire to which the selected cows may be mated; and (4) in the careful feeding and handling of the herd, with unrelaxing attention to detail.

Eucalyptus gigantea.—The State Forest Service states that in 1917 an experimental area of *E. gigantea* was planted on the Kaingaroa pumice plateau. Its establishment has proved successful, and demonstrates that this very valuable timber-tree is suitable for planting in districts of low winter temperature.

THE TOMATO-CATERPILLAR MOTH.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

THE tomato-caterpillar moth (*Heliothis obsoleta* Fab.) is one of the most widely distributed and destructive insects to field, garden, and orchard crops. It occurs throughout the world, attacks a wide range of plants, and is practically omnivorous. As a field-crop pest in New Zealand it is not so outstanding, although it is commonly found associated with army worms (*Cirphis unipunctata* and *Melanchra composita*), and feeds on the ears of maize, millet, &c. To the gardener and orchardist, however, it is of considerable importance, since it attacks tomatoes, beans, apples, peaches, &c.

The adult moth (Fig. 1) measures about ¾ in. in length. The colour and markings vary a great deal, being greyish-white, greenish, reddish-brown, &c. The hind wings usually have a dark area along the outside edge, while the front ones have darker transverse markings of varying intensity. During the spring months the first flight of moths appears. The moths are most active as evening approaches, when the females lay their eggs either singly or in batches up to nine hundred or more upon the stems or leaves of any one of the host plants. Within a few days the minute caterpillars hatch, and make a meal of the empty egg-shells before progressing in search of a vegetable diet. As they grow in size, damage caused by the caterpillars becomes more conspicuous, and it is then usually that the grower first becomes aware of their presence. In the case of the tomato or apple the caterpillar eats a hole through the skin of the fruit and excavates a large cavity within (Figs. 2 and 3), the damage being more apparent the older the caterpillar gets.

The caterpillar (Fig. 4) is ornamented by numerous stripes, the colour of which shows a great range of variation (reddish, blackish-brown, or greenish, &c.) in different individuals. When full grown the caterpillar measures up to 1½ in. long, and leaves the fruit, usually dropping to the ground, into which it burrows to a variable depth according to the nature of the soil. Some have been found as much as 7 in. below the surface, but as a rule they do not burrow so deep. The caterpillar then constructs an earthen cell in which it transforms to the brownish pupa. The period between hatching from the egg and transformation to pupa varies from four to six weeks during colder weather, and from about three to four weeks in the warm seasons. The pupal stage varies from about a fortnight to a month according to climatic conditions.

The number of broods, which may vary from three or more, is also dependent on climatic conditions; the broods are not always well defined, there being a considerable overlapping. The insect passes the winter in the pupal stage underground, and the larvæ from the first spring brood feed for the most part on foliage or on immature fruit; the later broods are quite apparent from their depredations upon ripening fruit. During last November a considerable amount of damage to young apples was recorded from Hawke's Bay and Gisborne by the Orchard Instructors for these districts (Mr. W. H. Rice and Mr. M. Davey respectively).

FIG. 1. ADULT TOMATO-CATERPILLAR MOTHS. ABOUT NATURAL SIZE.
[*After Kentucky Ag. Exp. Stn. Bull.* 187.

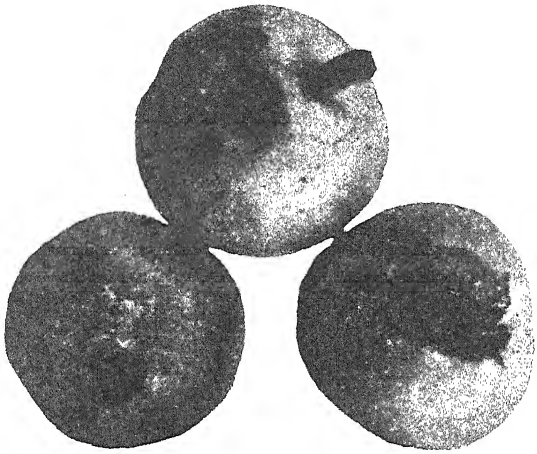


FIG. 2. YOUNG APPLES DAMAGED BY TOMATO-CATERPILLAR MOTH. NATURAL SIZE.

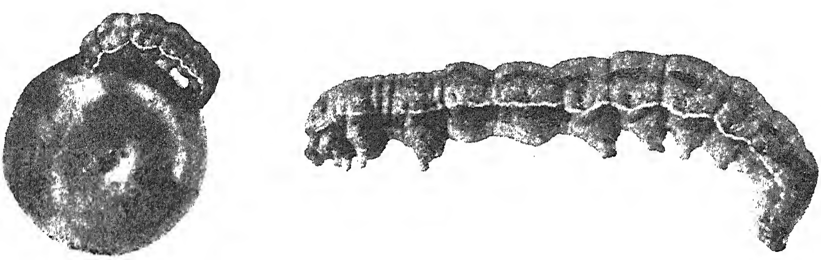


FIG. 3. TOMATO-CATERPILLAR ATTACKING YOUNG APPLE. NATURAL SIZE.
FIG. 4 (RIGHT). TOMATO-CATERPILLAR. × 2.

The tomato-caterpillar can be controlled by an arsenate-of-lead spray, particularly when the caterpillars are but little developed. In the case of crops, such as tomatoes, which are being more or less continually worked over, an outlook should be kept for very young larvæ, which can be readily destroyed by the spray. In view of the subterranean habit of the pupa, thorough cultivation, particularly during the winter months, is beneficial.

VINE-CULTURE UNDER GLASS.

(Concluded.)

W. H. TAYLOR, Horticulturist, Wellington.

DISEASES AND PESTS OF THE VINE.

Powdery Mildew (Uncinula necator).

THIS fungus appears in the form of greyish patches of mould on leaves and young shoots. Where neglected the whole surface of the leaves may become covered with the mould. On the berries it at first appears as a white powder, like lime, but when much developed the mould looks like a grey felt, completely enveloping the berries. Powdery mildew is known to most grape-growers by its old name of *Oidium Tuckeri*. While one of the most destructive vine-diseases when allowed to run its course without effective check, it is yet not feared by expert growers. Probably no crops are grown entirely free from mildew, but where the vines are under expert management infection is of a trifling character and easily controlled. The frequent cases of crops being ruined by this disease are entirely due to mismanagement.

Attacks are most likely to occur during the early period of growth, when leaves, shoots, and fruit are all young and tender. If the attack is severe, and is not checked, it will persist during the whole season. Autumn attacks are also common, occurring in houses which have been free from the disease till that time. This is accounted for by the increased atmospheric moisture and longer nights at that time. In such circumstances, if the vines have been allowed to make a considerable amount of young growth, as is frequently the case, this is fi st attacked, the mildew then quickly spreading to the older leaves. Attacks at this time are of no particular consequence, however, as they do very little harm.

The spores of powdery mildew are present everywhere, but they develop only in circumstances suitable to their growth. The conditions that favour germination of the spores are excessive cold on tender vegetable surfaces. In vineries attacks usually occur in the morning, and are caused by the sun, or more frequently newly admitted air, reaching tender growth wet with the condensed moisture that collects during the night. This causes sudden evaporation of the moisture, which lowers the temperature on the affected surface nearly to freezing-point. Infection can be prevented by avoiding these conditions. The top ventilators should be opened before the sun shines on the roof in the morning, so as to promote a slight movement in the atmosphere of the house. This movement will increase as the temperature rises. The moisture on leaves and berries will thus be slowly dispelled, so that all will be dry before the sun gains much power. The bottom ventilators should be kept closed till the vines are dry, as admitting bottom air while moisture remains on the vines is the most frequent cause of mildew. Cold draughts may be caused by leaving open spaces where rods planted outside pass through the wall of the house. These spaces should be blocked with sacking, or by other means. Any other open spaces, such as occur under the plates, should be

stopped, and the glass should be kept in good repair. In medium climates the bottom ventilators can be kept closed till colouring begins, and this course is best. In warm districts it cannot be done, but in no case should they be opened before the foliage is dry. If these precautions are taken, and provided the aspect of the house and other conditions are suitable for grapes, mildew will not be a serious trouble. Mild attacks are always likely to occur, however, and should be watched for.

A dusting of dry flowers of sulphur, applied on the first sign of the disease, will control it. The sulphur must be quite dry, and, before use, should be placed between folded paper and well rolled with a dry bottle or rolling-pin. Sulphur-bellows may be necessary in large vineries, but for small houses the best plan is to carry the sulphur on a sheet of paper, and, holding the paper under a bunch or leaf—whichever has to be treated—lift a fair amount of sulphur and let it fall on the affected bunch or leaf. A slight jar will then cause most of the sulphur to fall back to the heap on the paper; but sufficient for the purpose will cling to the fungus. This method ensures an ample dusting being quickly applied; it arrests the progress of fungus not yet visible to the unaided eye, and no sulphur is wasted.

If mildew is not effectually checked in its early stages it may, during the stoning-period, become epidemic, involving the whole surface of the vine, fruit, leaves, and young bark. In such cases dusting with sulphur would have but little effect; more drastic treatment must be given. Mix a good handful of sulphur with sufficient milk (skim-milk will answer) to make a thin paste, beating out all lumps. Place the mixture in a kerosene-tin and fill up with tepid water; the water must not be more than tepid or the milk will curdle. About an hour before the sun leaves the roof of the house in the evening close all the ventilators and thoroughly syringe the whole of the vines and the walls of the house with the solution. The solution must be kept well mixed, this being done by discharging the syringe back into the tin now and again, and thrusting it nearly to the bottom of the tin each time of charging before pulling up the piston. Open the top ventilators before daybreak the next morning so as to dry the vines before the sun reaches them. On the evening of the second day after treatment close up the house again and thoroughly syringe the vines with clean tepid water. The writer has proved this method to be completely effective in getting rid of the worst attack of mildew. This treatment cannot, however, be recommended for use earlier in the season while the foliage is tender, as burning would be sure to result.

Vine Sclerotinia (Sclerotinia Fuckeliana).

The Department's Biologist has reported ripe grapes received from Auckland to be affected by this disease. On the leaves the disease shows as a mouse-coloured, fluffy mould. Ripe grapes are caused to shrivel to dark purple-coloured mummies, which remain attached to the stems. As the disease cannot occur except in a very damp atmosphere, which should not be allowed, it is not considered necessary to describe the fungus fully. Where it occurs, the conditions of the house should be altered by proper ventilation. The mould form of the disease can be checked by spraying with liver of sulphur at the rate

of ½ oz. to a gallon of water. All dead leaves and wood pruned off should be collected and burned, and the house thoroughly cleaned. These precautions should be taken even in the case of vines not affected by disease.

Grape-spot.

This disease, which rarely attacks any but thin-skinned white grapes, is stated to be probably caused by the fungus *Gloeosporium fructigenum.* Brown spots—which increase in size, rupture the cuticle, and cause a rot—appear on ripe grapes. Once a berry is attacked there is no remedy, and affected berries should be cut off. It is not practicable to spray ripe grapes, therefore the only remedy is to increase the ventilation and prevent as far as is possible an accumulation of moisture during the night. This involves keeping late growths from crowding the trellis.

Shanking.

Sometimes the footstalks of the berries and even the stems of the bunches wither; they are then said to have shanked. This trouble is not caused by a disease proper, but by a cultural defect. Shanked berries fail to colour or ripen properly, and are sour and uneatable. Different opinions are held as to the exact cause of shanking, but all agree that it is a root trouble, and that it is induced by the roots being in sour soil. Sour soil need not necessarily be wet soil, though excessive wetness will cause shanking, and should be remedied by attention to drainage. Roots growing down into cold subsoil may be the cause, and they should be encouraged to remain nearer the surface. Again, when the vines are furnished with leaves very thin in texture shanking may be expected.

All these things result in, or are the result of, an imperfect balance between root and top. Where there is too much organic matter in the soil soft spongy roots are formed which cause an excessive growth of soft foliage early in the season. Later on these spongy roots die, leaving the vines with insufficient roots to feed a gross leafage. The remedy is to restrict root-action by rigid and timely suppression of early lateral growth, in the manner described in the section of this series on routine management. In this way the formation of spongy roots is checked, and the results which would arise from their loss later on are not experienced. Cases are recorded where shanking had been extensive for a number of years, but had since been avoided by the simple means indicated above.

Scalding.

Scalding occurs both on leaves and on berries, in some cases being extensive and causing serious losses. This affection, like shanking, is usually spoken of as a disease, but this is not correct, as no pathogen has been found in either case. Scalding, or scorching, may be due to the direct action of the sun or to variations in temperature. When occurring on leaves it is in nearly all cases due to the action of sun-rays on damp foliage; it may occur at any time of the day. If foliage is allowed to crowd up against the glass the passage of air is prevented, and the leaves remain wet till dried by sun-heat; burning is sure to take place in such circumstances. To a lesser extent leaves may be burnt by the focusing of sun-rays through faults in the glass. The common glass used is full of such faults, and it is rare that some

amount of burning does not occur from this cause, but never to a harmful extent. Berries exposed to the direct rays of the sun may also be scorched, this generally occurring near or during the ripening-period. Scorching also takes place when the vine-leaves are very thin, and cases are met where considerable damage has been done in this way. Leaves of a flimsy texture are unable to withstand the heat of the sun, and burning results. This condition is due to a want of plant-food; it can be remedied by supplying what the vines need. Another cause of this condition is dryness at root and an arid atmosphere, resulting in semi-starvation with consequent feeble leafage, which is bound to scorch. It would perhaps be better to speak of these occurrences as "scorching," which it really is, rather than as "scalding"; they are not the affections usually meant by authorities when speaking of scalding.

Scalding proper occurs during the stoning-period, and sometimes causes very serious losses. It has been previously stated that the stoning-period is a critical time. The berries, during the three or four weeks of stoning, make practically no increase in size, and are very susceptible to injury, so that any attempt to force them into growth is likely to result in damage being done. Scalding in this case is not due to direct sun-rays, for berries that the sun cannot reach are scalded. It is due to a too-wide range between day and night temperature, combined with atmospheric moisture. Damping-down should therefore be reduced to a minimum, and a little top air should be left on all night, except during bad weather. More air should be given very early in the morning to dispel moisture and, above all, to prevent a sudden rise in temperature. During the day the temperature should be kept as low as is consistent with proper ventilation. The greatest danger is a sudden rise of temperature in the morning.

Warted Leaves.

This is a very common affection, occurring mostly in the warmer districts. The leaves affected are usually of a gross character, indicating that the roots are in rich soil. Such leaves are heavily charged with water, and are very susceptible to injury. The damage is done by sudden evaporation of moisture from the gross foliage, usually caused by a current of cold air admitted before the foliage has dried. The leaves have a rough surface, covered with warts or intumesences.

Aerial Roots.

It is not uncommon to see vines with bunches of aerial roots hanging down from each spur. The cause may be a warm and moist atmosphere combined with lack of proper ventilation. In most cases, however, it is due to faulty root-action, the roots having got down into cold soil. This again may be due to poor drainage. In any case it is not a desirable state and should, if possible, be put right.

Mealy Bug (Dactylopius adonidum).

This insect is aptly described by the common name applied to it, the term "mealy bug" serving to distinguish it from any other grape-vine pest. The rapidity with which the insect propagates, and its habit of depositing its eggs under the bark, beneath the scales of buds, and in crevices in the building, particularly the rafters, make it the

most difficult of all insects to get rid of. In small vineries it should not be a continuous pest, as it is possible to clean it out. The case of large houses is different; it would be impossible to devote the necessary time to the pest if the same means were adopted that are applicable to small houses.

The mealy bug has been the subject of more writings than probably has any other insect, and a good many recommendations have been made for its eradication. A number of different dressings for the rods have been recommended, such as washing with soft-soap or with paraffin, and dressing with a mixture of coal-tar and clay. Although these recommendations are well authenticated, and have been put into practice with good results, yet cases have occurred of the rods being killed by each one of them. The fault, however, has not been in the dressing, but in the method of application. A vine-rod is very porous, and, unless protected by its bark, is capable of soaking up anything of a penetrating nature. It is a general custom to scrape off all the bark which it is possible to remove, but, as pointed out earlier in this series, only that bark which is hanging loose may safely be detached; all that is firmly attached should remain. Bark is often scraped off because it is thought the bug gets under it, but the insect cannot get under unless the bark is loose. If a natural covering of bark is left, a fairly strong dressing may safely be applied. It appears, however, that there is danger in the use of strong dressings, and it is therefore best to avoid them.

Scrubbing the rods with hot water has been found by many growers, including the writer, to be effective. First remove loose bark and loose scales around the buds; then scrub the rods with a fairly stiff brush, using water at a temperature of about 130° F., which is hot enough to kill the bugs but will not injure the buds. In bad cases the rods should be scrubbed twice—at the time of pruning, and again a few weeks later. Before the buds begin to move, dress the rods with a solution of Gishurst's compound—8 oz. in a gallon of water, applied with a paint-brush. All prunings and leaves should be carefully collected and burned, and everything needful done to thoroughly clean the house, so as to get rid of bugs that have fallen to the ground. The rods must, of course, be taken down for cleaning; before tying them up again thoroughly and forcibly spray the whole interior with a solution of kerosene emulsion at a strength of 1 in 12. The wires of the trellis should be rubbed with a rag soaked in kerosene. While the vines are in growth keep at hand a tin containing a little kerosene and an old tooth-brush. When a bug is seen touch it with the brush just wetted with kerosene, and it will be instantly killed.

Tedious methods are not possible in large houses, however, and for these fumigating with hydrocyanic-acid gas appears to be the only way to get rid of the pest. This gas is of a deadly nature, and human life is endangered by any carelessness. It is therefore best to avoid its use where other methods can be made effectual. A good deal of care in its use is necessary while the vines are in growth, as it can easily kill tender foliage, either of the vine or of other plants, and can also injure the berries. In theory, damage from its use can be avoided, but it proves to be difficult in practice. It is noticed that authorities in England now advise its use only after the grapes have been cut, and this is, no doubt, the wisest course. As fumigation does

not kill the eggs, a second treatment should be given before the leaves have fallen.

Fumigating should be done towards evening, when the heat of the sun has declined; the temperature should not be above 70° F. The house should be made airtight, and the vines and building should be as dry as possible. After treatment, the house may be kept closed all night, but must be opened before sunrise in the morning. When opening the doors care must be taken not to breathe the air of the house, and the house should not be entered till one hour after the doors have been opened.

For every 1,000 cubic feet of space in the house use 4 oz. avoirdupois of potassium cyanide, 4 fluid oz. of commercial sulphuric acid, and 12 fluid oz. of water. Provide an earthenware basin for every 10 ft. of length in the house, the basin to be of a size proportionate to the amount of chemicals it will be required to hold. The necessary quantities of cyanide should first be weighed out and placed in pieces of tissue paper, which should then be placed in the positions where the basins will be. If the cyanide is in large lumps these must be broken until they are not larger than a filbert nut. The water should first be placed in all the basins, and then the sulphuric acid. The cyanide in the paper should be added last of all; begin at the basin farthest from the door, holding the breath and retreating as quickly as possible. The paper will delay the action of the acids for a moment or two. When sulphuric acid is added to the water heat is generated, and it is important that the cyanide be added before this heat declines; if it has cooled down the generation of gas will be slower and less in volume. A good grade of sulphuric acid should be used; low grades may contain nitric acid, which would cause burning.

Red Spider (Tetranychus telarius).

This is a minute brick-red insect that attacks the leaves. If present in great numbers the vines are debilitated, as the insects suck the juices from the leaves. It is troublesome only where hot, dry conditions prevail, and in most parts of New Zealand need not be a source of trouble. The way of avoiding attacks is to supply sufficient moisture to the roots, and to prevent arid conditions in the house by damping down and syringing. The warmer parts of the Dominion are most favourable to the pest, but the very conditions that favour the spider make it possible to use more water in the house. A number of recommendations for its eradication have been made, but so difficult is it to get rid of the spider without injuring the vines that all agree that treatment which will prevent an attack is the best course.

Thrips.

The thrip is a tiny insect, dark in colour when matured. It is a sucking-insect like the red spider, but is more destructive than that pest. Like the red spider, these insects thrive in dry conditions, and treatment that will prevent attacks by spider is usually effective for thrips. If an attack occurs, fumigation with X.L. All fluid or tobacco two or three nights in succession will control it. Tobacco should not be used when the berries are ripening, as the flavour of the tobacco remains for some time. A thorough cleaning of the vines and house on the lines previously indicated is essential to the riddance of both thrips and red spider.

TOP-DRESSING OF FIORIN GRASSLAND.

THE ALFREDTON EXPERIMENT CONTINUED.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Wellington.

IN the *Journal* for March, 1922, the writer gave an account of a pasture top-dressing experiment conducted at Alfredton, situated in the Wairarapa bush country about twelve miles east of Eketahuna. The ground chosen for the experiment was a badly drained but gently sloping white-papa clay. The flora of the paddock two seasons ago, before top-dressing was undertaken, consisted almost entirely of grasses of the *Agrostis* species. This particular paddock was chosen for experiment because it was typical of much of the sheep-country in the surrounding district, and especially of part of the Tiraumea Soldiers' Settlement.

The 7-acre paddock treated was divided into seven plots, each an acre in area. The lower half of the paddock was limed, so that half of each plot received a dressing of lime at the rate of 1 ton per acre. The experiment has now been in progress for two seasons. In the 1921–22 season four of the plots were top-dressed, while three remained as control areas. No further fertilizer was applied last autumn, and Plots 6 and 7 were eliminated from the area under experiment. For the sake of convenience it will be well to repeat the arrangement of the plots and their treatment :—

Plot 1, control, (*a*) limed, (*b*) unlimed.

Plot 2, 2 cwt. Nauru superphosphate, (*a*) with lime, (*b*) without lime.

Plot 3, 2 cwt. Nauru ground-rock phosphate, (*a*) with lime, (*b*) without lime.

Plot 4, control, (*a*) limed, (*b*) unlimed.

Plot 5, 2 cwt. Ephos phosphate, (*a*) with lime, (*b*) without lime.

The higher portion of the paddock, which was unlimed, is somewhat irregular in contour, but the lower portion, which was limed and which includes half of each plot, slopes evenly towards the road, and contains soil of a fairly even type, so that comparison made from weights taken from the limed areas should admit of a reasonable degree of validity. The paddock chosen, so far as its contour is concerned, is typical of the average paddock likely to be top-dressed in the district, and for this reason the choice was the best that could possibly have been made in the circumstances.

The paddock has been inspected from time to time, and interim reports made on the various plots. It must be remembered that in such an experiment more is to be gained by a close study of pasture-composition and of the transitions that take place than is to be gained from a casual perusal of weights taken in December or January. There is ample evidence to show that top-dressing has been of great benefit on this area. During the first twelve months after the application of fertilizers the English grasses which had been sown in previous years, but had been smothered out by brown-top, began to make their appearance again. This was especially noticeable with perennial

rye-grass on the plots treated with superphosphate after lime. In the spring a great growth of meadow-foxtail was to be seen, while in January timothy-heads made their appearance. White clover made a good showing on all the manured plots.

A careful study of the flora reveals the fact that the omission to top-dress the paddock last autumn has been responsible for the marked intrusion of weeds and poorer grasses, notably tarweed (*Bartsia viscosa*), Yorkshire fog (*Holcus lanatus*), and sweet vernal (*Anthoxanthum odoratum*). It is evident that land such as that under study at present should receive an annual dressing of at least 2 cwt. of phosphatic manure per acre, but a larger dressing of 3 cwt. to 4 cwt. would be preferable. The following interim report will give some idea as to the state of the plots at the time of an inspection made on 10th October, 1922 :—

Plot 1 (control) : Fair growth, poor colour, not as good as central control. Sweet vernal and moss very noticeable, also red-top on unlimed portion.

Plot 2 (Nauru superphosphate) : Decided difference between this plot and No. 3 at the boundary. This plot is undoubtably the best in the paddock ; colour and growth good. Growth on limed and unlimed portions about the same.

Plot 3 (Nauru ground rock) : Unlimed portion looks decidedly better than the limed ; very little foxtail and cow-grass to be seen.

Plot 4 (control) : Easily picked out : sweet vernal noticeable ; poor colour. No perceptible difference between limed and unlimed portion.

Plot 5 (Ephos) : Fair amount of foxtail and clover showing ; unlimed portion slightly better than limed.

Weighings were taken from the various plots on 21st December, 1922. If we were able to balance the extra water-content of the grass at this date against the extra growth that would have taken place between 21st December and 18th January (the date on which weighings were made last year), it is probable that our results would admit of comparison with those of last season. The following were the green weights for this season (taken on 21st December) in tons per acre :—

(1.) Control, limed, 6·2 tons ; unlimed, 4·9 tons.

(2.) Nauru superphosphate, limed, 13 tons ; unlimed, 10 tons.

(3.) Nauru ground-rock phosphate, limed, 6·75 tons ; unlimed, 8·8 tons.

(4.) Control, limed, 5·9 tons ; unlimed, 6·7 tons.

(5.) Ephos phosphate, limed, 5·7 tons ; unlimed, 7·9 tons.

On a percentage basis the results may be stated as follows : Controls, unlimed, 100 ; controls, limed, 104 ; Nauru super with lime, 224 ; Nauru super without lime, 172 ; Nauru rock with lime, 116 ; Nauru rock without lime, 152 ; Ephos with lime, 100 ; Ephos without lime, 136.

The use of lime without manure does not appear so far to have shown any very appreciable effect this season, either in the actual pasture-composition or in the yields from the respective plots. It will be seen from the foregoing figures that the difference between the average from the limed controls and that from the unlimed controls is a negligible one. Nauru superphosphate used with lime has doubled the results given on the control plot. Superphosphate used alone has shown an advantage of 72 per cent. over the controls. Nauru ground rock used with lime has shown very little advantage over the untreated

plots. As might be expected, however, on this soil, which is very sour, the ground-rock phosphate used without lime has increased the yield, in this case by 52 per cent. Ephos with lime has not increased the yield, while Ephos alone (if experimental error is allowed for) has given somewhere about the same return as Nauru ground rock. On sweeter and drier soil Ephos would probably have acted much more quickly than rock phosphate used alone.

Since the rainfall and its distribution have such an important influence upon the growth of pasture-plants, the following record, kindly supplied by the Director of the Dominion Meteorological Office, is of interest :—

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
						Rainfall (Inches).							
1921	1·93	1·35	1·86	1·67	2·87	3·70	5·30	6·96	2·93	8·84	5·54	8·42	51·37
1922	3·82	2·14	8·39	4·67	1·54	1·92	3·34	4·22	2·36	4·23	4·15	4·12	44·90
						Number of Wet Days.							
1921	11	4	9	9	13	16	19	18	11	21	14	14	159
1922	15	10	24	13	12	18	15	16	13	13	21	17	187

TESTING OF PUREBRED DAIRY COWS.

FEBRUARY CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE following list comprises the records of cows which received certificates during February, 1923 :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
August's Cherrybud ..	J. Nicolson, Kaupokonui	1 360	240·5	365	9,490·7	509·29
Holly Oak's Tiny ..	H. P. Pickerill, Ravensbourne	2 0	240·5	365	8,400·1	489·23
Wairoa's Gleam ..	H. J. Berry, Kaupokonui	2 38	244·3	365	8,321·5	488·78
Heroine's Pride's Idol	H. J. Berry, Kaupokonui	1 358	240·5	365	7,616·2	469·81
Ivondale's Glory ..	P. J. Petersen, Waitara	2 32	243·7	344	7,192·6	400·40
Abberly Naomi ..	H. E. B. Watson, Christchurch	1 326	240·5	365	8,144·4	392·70
Holly Oak's Rose ..	H. P. Pickerill, Ravensbourne	2 31	243·6	365	7,695·0	386·88
Ulster Lassie ..	W. A. Officer, Inglewood	1 297	240·5	325	6,064·3	372·18
Rosemont Princess ..	E. L. Rose, Pukekohe	1 342	240·5	365	5,922·6	356·28
Queen Maggie ..	A. Mouldey, Tirau ..	2 11	241·6	361	5,796·3	343·39
Nonpariel	S. J. Bennett, Kaupokonui	1 307	240·5	317	5,723·3	331·15
Middlewood's Mona..	Kilgour and Gibson, Kiwitea	1 264	240·5	365	5,425·0	326·10

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Junior Two-year-old— continued.		Yrs. dys.	lb.		lb.	lb.
Snow View Wish ..	H. Purdie, Waitara ..	1 338	240·5	259	5,055·0	310·58
Gowanbrae Melia Ann	R. W. B. Evans, Wera-roa	2 13	241·8	300	5,874·7	309·58
Erinview's Queen ..	J. Murray, Woodville	2 0	240·5	316	6,016·5	303·94
Wattleflower ..	F. C. Ross, Kiwitea ..	1 364	240·5	328	6,124·3	300·32
Springbank Ringlet..	E. S. Holdaway, Bal-lance	2 8	241·3	283	5,547·5	290·31
Adora's Jewel ..	H. Moreland, Newstead	1 218	240·5	365	5,825·5	285·90
Springbank Buttercup	E. S. Holdaway, Bal-lance	2 14	241·9	304	4,809·5	242·53
Springbank Beauty..	E. S. Holdaway, Bal-lance	1 340	240·5	320	4,864·5	241·78
Senior Two-year-old.						
Collingwood's Angel	Mrs. E. Hellyer, Dun-edin	2 149	255·4	365	8,420·0	518·77
Rapa's Silver Queen	S. R. Lancaster, Pal-merston North	2 230	263·5	354	9,989·5	493·29
Holly Oak's Lady ..	H. P. Pickerill, Ravens-bourne	2 135	254·0	365	7,791·5	470·66
Snow View's Zephyr	H. Purdie, Waitara ..	2 362	276·7	363	9,316·7	456·03
Aberbrothock's Effie	W. Corkill, Aratapu ..	2 194	259·9	326	5,306·2	315·23
Confetti	A. Eddie, Mangahao..	2 332	273·7	365	6,203·7	279·97
Springbank Nell Ally	E. S. Holdaway, Bal-lance	2 119	252·4	304	5,476·1	272·41
Four-year-old.						
Silverdale Rose ..	G. Hodgson, Whaka-para	4 185	332·0	365	9,734·2	549·69
Brookland's Claribelle	J. G. Kenyon, Hamilton	4 326	346·1	365	9,637·9	491·63
Roslyn Twin Girl ..	J. Torbet, Waiau Pa..	4 19	315·4	365	7,549·0	442·19
Mature.						
Molly Mahone ..	C. Stevens, Maunga-tapere	7 322	350·0	365	11,692·5	682·61
Jewel Chimes ..	G. Hodgson, Whaka-para	7 6	350·0	354	9,730·7	606·90
Georgia	C. Stevens, Maunga-tapere	6 257	350·0	365	10,750·7	604·73
Lady Winnie ..	E. Townshend, Aria ..	6 82	350·0	365	8,858·0	592·72
Verona	G. Hodgson, Whaka-para	8 216	350·0	363	9,801·6	580·24
Pulchra's Queen ..	G. H. Bell, Oakura ..	5 79	350·0	281	10,241·2	538·86
Patch's Lily ..	R. C. Leach, Woodville	9 27	350·0	337	8,742·4	490·54
Lady Wattles ..	F. C. Ross, Kiwitea ..	5 94	350·0	365	9,002·2	414·63
Te Wi Pearl ..	E. Griffiths, Cambridge	8 308	350·0	333	7,251·5	413·82
Lady Mangalina ..	T. Foreman, Alton ..	6 324	350·0	341	6,610·0	411·21
Heather Flower ..	J. Linn, Normanby ..	5 319	350·0	315	6,697·8	381·76
	FRIESIANS.					
Junior Two-year-old.						
Jessie Monona Johanna Oakview	H. R. Green, Kairanga	2 57	246·2	365	20,193·2	727·58
Coldstream Pontiac Wayne	V. Marx, Mangatoki ..	2 7	241·2	365	19,156·5	714·24
Coldstream Colantha Canary	Marchant and Sons, Cardiff	1 343	240·5	365	14,565·9	576·06

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS—*continued.*				
Junior Two-year-old— continued.		Yrs. dys.	lb.		lb.	lb.
Abbe Queen Segis ..	J. McAnulty, Winchmore Rural	2 60	246·5	365	15,975·0	513·10
Bainfield Betty ..	W. D. Hunt, Invercargill	2 163	256·8	365	14,558·1	491·81
Coldstream Rozine Fayne	Marchant and Sons, Cardiff	2 16	242·1	365	12,476·4	474·60
Bainfield Queen 4 ..	W. D. Hunt, Invercargill	2 16	242·1	365	11,528·5	443·68
Ellesmere Irene Mercedes	G. H. Hassall, Clarkville	1 312	240·5	365	10,961·2	422·55
Ashlynn 75th ..	D. Ross, Hamilton ..	1 313	240·5	354	10,802·9	415·75
Princess Pauline Pride	H. W. Hoskin, Mangatoki	1 309	240·5	352	11,804·1	406·72
Pareora Wild Rose Fancy	A. S. Elworthy, Timaru	2 42	244·7	365	13,643·2	405·89
Daffodil Lass 3rd ..	D. Ross, Hamilton ..	1 353	240·5	347	7,599·9	301·26
Dominion Lady Rowena	J. McAnulty, Winchmore Rural	2 47	245·2	253	7,895·3	256·31
Oaklea Felix Queen..	S. Knight and Sons, Ongarue	1 360	240·5	187	6,404·2	249·09
Johanna Royal Pride	S. Knight and Sons, Ongarue	2 61	246·6	333	6,584·7	247·36
Senior Two-year-old.						
Bainfield Vanity ..	T. R. Eades, Edendale	2 239	274·4	365	16,614·0	535·33
Junior Three-year-old.						
Rosevale Isobel ..	H. North and Sons, Omimi	3 86	285·6	365	19,627·8	613·74
Senior Three-year-old.						
Cordyline Cherry Cheer	G. Aitchison, Kaitangata	3 288	305·8	365	17,900·5	602·08
Blanco 4th 3rd 1st Daughter	D. Ross, Hamilton ..	3 243	301·3	364	13,976·2	565·84
Medbury Dutch Buttercup	G. H. Hassall, Clarkville	3 245	301·5	365	12,906·0	393·12
Junior Four-year-old.						
Oakwood Betty ..	W. D. Hunt, Invercargill	4 9	314·4	365	21,748·0	810·11
Midnight 2nd ..	F. O. Stack, Kiwitea..	4 98	323·3	365	12,783·3	468·18
Bainfield 28 ..	T. R. Eades, Edendale	4 70	320·5	320	12,754·5	455·41
Senior Four-year-old.						
Rosevale Nellie ..	H. North and Sons, Omimi	4 345	348·0	365	17,180·2	678·31
Knight Princess of Friesian Holm	W. A. Officer, Inglewood	4 353	348·8	281	10,560·0	414·05
Mature.						
Rosevale Beets de Kol	H. North and Sons, Omimi	7 133	350·0	365	24,072·4	819·31
Monavale Aaggie Regina	R. C. Allen, Piako ..	6 88	350·0	365	15,943·9	585·58
Colantha de Kol ..	Marchant and Sons, Cardiff	5 54	350·0	365	16,394·2	582·63

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
FRIESIANS—*continued*.						
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Lakeside Diamond ..	L. McKelvie, Bull's ..	7 120	350·0	365	15,100·8	506·66
Jule's Colantha of Friesian Holm	John Stables, Riverlea	7 337	350·0	356	12,261·9	473·42
MILKING SHORTHORNS.						
Junior Three-year-old.						
Dilworth Bridget ..	A. J. Melville, Buckland	3 54	282·4	315	7,594·6	308·80
Mature.						
Sandy 3rd of Cornwall Park	J. Pease, Matatoki ..	10 295	350·0	365	11,288·5	473·26
AYRSHIRES.						
Four-year-old.						
Maud of Ivanhoe ..	A. M. Weir, Menzies Ferry	4 5	314·0	342	10,438·1	501·59
Mature.						
Dominion Blair Gowrie	Moumahaki Experimental Farm, Waverley	7 73	350·0	365	10,081·8	434·78
Bluebell of Glenweir	A. M. Weir, Menzies Ferry	10 347	350·0	292	9,717·9	407·37
Curly of Glenweir ..	A. M. Weir, Menzies Ferry	11 43	350·0	323	9,680·9	378·54
RED POLLS.						
Dominion Morocco ..	Central Development Farm, Weraroa	2 34	243·9	365	9,189·7	341·96
Dominion Netherlana	Central Development Farm, Weraroa	2 35	244·0	365	7,008·4	331·26

Second-class Certificates.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.						
Teuila	F. E. Day, Tamahere	1 332	240·5	365	4,552·8	271·58
Senior Two-year-old.						
Gift's Golden Maitland	F. Phillips, Otorohanga	2 292	269·7	311	4,996·9	279·06
Four-year-old.						
Una of O.K. ..	V. W. Nowell, Hawera	4 0	313·5	236	8,221·3	488·43
FRIESIANS.						
Senior Three-year-old.						
Ardmore Plum 3rd ..	W. Potter, Mangere ..	3 330	310·0	364	12,268·7	424·28

Advice has been received through the High Commissioner, London, that the English hop crop of 1922 was 320,000 cwt., as against 240,000 cwt. in 1921, and that, in addition, 6,000 pockets of the 1921 season's crop remained unsold in December last. Owing to this position and the doubt existing as to whether the brewing trade could absorb the stocks in question, no import permits were to be issued for the present. The Hop Controller had fixed the average price of the 1922 English crop at £10 10s. per hundredweight, as compared with £18 in the previous year.

SEASONAL NOTES.

THE FARM.

FIELD CROPS AND PASTURES.

Autumn Sowings.

APRIL is a good time generally for the sowing of oats intended for threshing or cutting into chaff. If put in during this month they provide a lot of green feeding during the winter and spring, and ripen early. Algerians have many merits, and may be sown at the rate of 2½ bushels per acre. Where required a suitable manure is a half-and-half mixture of superphosphate and Nauru rock phosphate, 1 cwt. to 2 cwt. per acre.

May being recognized as the month for beginning autumn sowings of wheat, land intended for this crop should be cultivated all through April, as it is well to get the seed-bed prepared in advance. It should be borne in mind that manures do not take the place of cultivation, but are an adjunct to it. If the soil is not properly worked and consolidated no amount of fertilizer will ensure a good crop.

Where not already done the sowing-down of pastures should be pushed on as fast as possible, as late sowing generally means a big reduction in the clover content. From now on, particularly in the colder situations, it is often good practice to sow a bushel of Cape barley or one of the white oats with the grass-seed, to provide shelter for the young clover.

The sowing of winter and early spring forage crops should as far as possible be completed in March. Though much of this work is done in April, the value of early sowing generally may be stressed. Suitable crop-mixtures and fertilizers were indicated in last month's notes.

The Potato Crop.

From now on main-crop potatoes will be ready for lifting. The tubers should be carefully sorted, and those intended for marketing later pitted on a well-drained piece of land, the pit being well thatched to keep out frost and winter rains. Potatoes intended for seed should be stored in a cool, dry, well-aired shed.

Liming and Top-dressing.

In many districts April is the best month for liming. When lime is being applied to arable land it should be broadcast and worked into the soil in course of the final working. If the lime is applied as a top-dressing to pasture, the farmer should have fixed in his mind the necessity for following it up by an application of phosphates in the spring. Though more difficult to handle, crushed burnt lime is generally more satisfactory and more economical than carbonate, as about half the amount is the equivalent and gives quicker results.

Irrigation Farming.

Where irrigation farming is practised, especially in Central Otago, every endeavour should be made during April to break up land intended to be sown out in the spring. This ploughing should not be delayed until later, as the ground would then in all probability be too hard. From now on preparation should be made to have contour ditches cut, leading water to those places in the various paddocks which during the past season have proved hard to irrigate. This particularly applies to undulating country. Low-lying parts of the paddocks which become flooded during the irrigation season should have open drains cut, so as to allow surplus water to be carried off to lower levels. Ditches can now be cleared while still soft, and all boxes which have become disrepaired during the season should have attention.

On low-lying more or less flat country which has not previously been brought under irrigation, ploughing and preliminary levelling should be carried out with a view to laying out the land in a series of checks for border irrigation. This method, which was described in the December, 1921, *Journal*, requires well-levelled land, and much can be done in respect to such levelling at the time of autumn ploughing.

Feeding of Forage Crops.

At this period green maize is often fed to dairy cows, being cut as required and carted out. Sorghum which has come into head can also be fed like maize. Though opinions differ as to whether or not immature sorghum is poisonous, it is not worth the risk of feeding it before it flowers. Millet can be fed off green. It is advisable, if the area of millet is large, to feed off in breaks. Fifteen acres could be divided into three areas. Any excess from these crops should not be allowed to go to waste, but be conserved as silage. It is good practice to have such crops as maize and millet cleared up before sharp frosts set in.

The time is approaching when stock will be put on to hard turnips and swedes where such enter into the farm practice. Provision should have been made for the stock to have a run-off of pasture on which they can get the necessary roughage, which is essential to the health of ruminants feeding on root crops.

Reclamation of Tidal Swamp Lands.

The first operation in the reclamation of tidal swamp lands or mud-flats is the construction of a stop-bank. The general dimensions of stop-banks under New Zealand tidal conditions are 15 ft. to 20 ft. width at the base, 5 ft. to 7 ft. width at the top, and 6 ft. to 7 ft. in height. The bank-drain is first dug. For small areas a ditch 12 ft. wide by 5 ft. 6 in. deep, sloping to a bottom 4 ft. wide, is sufficient, while for larger areas, involving, say, several hundred acres, the bank-ditch should be about 18 ft. to 20 ft. wide, sloping to a 7 ft. bottom. The material from the ditch is best shifted back 5 ft. to 10 ft. and built into the stop-bank. When the banks are formed they should be immediately grassed with buffalo and tall oat grass. The bottom of the outside of the wall often requires to be revetted with manuka fascines or stones.

The outlet through the stop-bank should be concreted, and the flood-gate hinged and fitted close to the concrete. Usually a fluming is required at the outlet for about 7 yards to carry the water into the river channel, otherwise a large hole forms in the river-bank and tends to undermine the wall. Wing walls for about 5 ft. on each side of the outlet are often required to prevent erosion by the river.

In most cases it takes about two years for an area to settle, in which time the surface may sink 2 ft. or more. Fleabane (*Erigeron canadensis*) is frequently the first plant to appear. This weed is well liked by stock, and encourages the animals on to the area. In from two to five years, depending on the saltiness of the land, the area is fit to sow in grass. Surface sowing usually gives the best results. The rushes are burnt off, the grass surface-sown, and the seed tramped in with sheep to encourage germination. A suitable mixture of grasses is as follows: Italian rye-grass, 6 lb.; perennial rye-grass, 10 lb.; cocksfoot, 5 lb.; timothy, 3 lb.; meadow-fescue, 2 lb.; crested dogstail, ½ lb.; Poa trivialis, ½ lb.; cow-grass, 2 lb.; strawberry clover, ½ lb.; alsike, 1 lb.; white clover, 1 lb.: total, 31½ lb. per acre. As an alternative in the North, 5 lb. to 9 lb. of paspalum-seed could be sown with a rye-grass and clover mixture.

Open ditches are dug round the area at the foot of the hills, and several longitudinal drains are usually required. After the area has settled, the land is greatly improved by liming and underdraining.

—*Agricultural Instruction Service.*

THE ORCHARD.

THE LATER APPLES.

Of the work immediately ahead, perhaps the harvesting of the later varieties of apples stands first. This class of apple usually keeps well, and is placed aside in store for late winter and spring use. The keeping-qualities of these varieties were so highly rated that some liberties were taken as to the period and the manner of picking and storing them. Heavy losses have made the growers alive to the

fact that nature will not be thus slighted. Of the many factors causing "flesh-collapse" or "brown-heart," one is the over-maturity or mixed maturity of the fruit at the time of picking, as scientific investigators have recently plainly proved. However convenient it may be to defer the harvest in order to make one picking suffice, it cannot be done satisfactorily. This class of apple hangs very firmly on the tree after maturity, and the outside may show little signs of mellowness, but the texture of the flesh is affected, and its life in store is seriously shortened. Pick as soon as properly matured and store without delay, and the reputation of these sterling sorts will be what it was. To do this satisfactorily at least two pickings must be made, care being taken to instruct inexperienced pickers.

FRUIT FOR STORAGE.

It is often a matter for surprise to see the quantity of low-grade fruit put into store. Even if the space costs nothing, the depreciation and extra handling on this class of goods in storage quickly balances any little profit that it promised. Nothing below "Fancy" and a good second grade are worth store-room and a double handling these days. If there is no other use for lower grades they should be fed to farm-stock.

AUTUMN SPRAYING.

The business of harvesting the crop often leads to the trees being neglected at this period. A grower with an eye to the future will carefully consider the trees of each variety as the crop is gathered, and should any disease be seriously troubling them immediate steps can be taken to cope with it. A bad attack of woolly aphis may be very successfully dealt with by spraying at this season of its maximum activity. Red mite at this period is making arrangements to tide over the winter months. With the crop off and diminishing foliage, a serious attack can now be readily repelled with a good spray. Where black-spot has been epidemic a spraying of bordeaux, 3–4–50, now will go a long way towards cleaning up the trees and preventing a large measure of the infection arising from the leaves about to fall and that are such a menace in the spring of the year. The same remark applies to the treatment of rust and brown-rot of the stone-fruit trees.

COVER-CROPS.

Many orchards require a cover-crop to add nitrogen, fibre, and humus to the soil, thereby enriching it and improving its mechanical condition for the purpose of the cropping trees as well as keeping the land clear of weeds. Such a crop may still be sown; oats and vetches are one of the best at this season.

PREPARATIONS FOR PLANTING.

Those contemplating planting new areas during the coming season should now carefully select and order their trees or plants. These must not be merely well grown, but of the right varieties and the best stock. No amount of care will make up for deficiencies under these headings. If the land is in grass or other growth break it up now, so that grass and herbage is thoroughly decayed and the land cleaned before planting. Whether the crop is to be trees or strawberry-plants the present excellent opportunity of cleaning the land will not recur for some time.

—*W. C. Hyde, Orchard Instructor, Nelson.*

CITRUS FRUITS.

In those groves where it is intended to put down cover-crops these should receive attention as soon as possible. The most economical method, and the one which will be found to be the most thorough, is to employ the farm drill for this purpose, sowing fertilizer at the same time where necessary. Owing to the rather erratic season and heavy rainfall which have been experienced practically throughout the Dominion the autumn blossoming may be expected to show up somewhat earlier this year, and it is therefore advisable to refrain from carrying out further cultivation at this juncture unless cover-crops are required.

As there has been a shortage of New-Zealand-grown lemons for several weeks past several growers have been picking quite immature fruit from the trees, with the idea of curing for market. This class of fruit is of no value commercially. It is obvious that there can be no keeping-qualities in fruit that is not allowed to reach a fair degree of maturity, and for this reason no fruit should be harvested before it has reached a size of at least $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. If curing is

to be carried out methodically the trees must be gone over once a month. While picking of immature fruits must be avoided, no lemons should be allowed to remain on the trees until they ripen off and become coarse and full of "rag."

Black aphis should be dealt with on appearance, using nicotine sulphate at 1-800.

FIREBLIGHT.

At this period it may reasonably be anticipated that infection will not make further appearance in the present season. Growers of pip-fruit trees should, however, remove and destroy any parts of a tree or trees that show suspicious symptoms—not only in their own interests, but also in those of their neighbours. Apart from this no further steps can be taken to deal effectively with this disease until the pruning season.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CARE OF THE PULLETS.

On all well-managed plants the general weeding-out of unprofitable stock will have been completed before now. This should enable the pullets to be provided with plenty of house-room and be made comfortable in every way. For many weeks to come it is the pullets that must be depended upon to fill the egg-basket. It should hardly require emphasizing that for them to do their best during the forthcoming season everything must be in their favour. The young birds should now be well settled down in their permanent quarters, as any change made in this direction just when they are on the point of laying or when they have commenced to lay is merely encouraging them to moult with the adult birds.

Any change of diet will also probably have this undesirable effect. Uniform feeding and management is not only one of the secrets of preventing a false moult, but it encourages a bird to attain its maximum of production. The best example of this is conveyed by the egg-laying competitions where the one diet is used practically from start to finish. While the food should be uniform in character it should also be fed with a liberal hand. Once the laying-period commences there need not be any danger of the birds being overfed. Remember that sufficient food is required not only to keep the birds in good physical condition but also for the production of eggs. The morning mash may consist of one part by measure of good-grade wheatmeal to two of bran, or, where a good quality of pollard is available, two of this to one of bran. In each case it should be moistened with milk, meat-soup, or boiling water, and mixed to a crumbly condition. Cold water will do for moistening purposes where milk or soup is not available, but by using boiling water the mash is made more appetizing, and consequently will be better relished by the birds.

Then, to secure a good winter-egg yield, animal food in some form is imperative. Where boiled meat is available this should be introduced into the ration by degrees up to, say, 1 oz. a day for each bird, preferably fed separately. In the absence of meat a good grade of meat-meal should be used. This may be included in the mash by degrees up to 8 per cent. of the entire mixture, while, in addition, some may be placed in a separate hopper and left for the birds to pick at all times. If ovarian troubles occur, this indicates that the ration is of too forcing a nature and that the amount of animal food should be reduced.

Equal parts of wheat, oats, and maize make a good evening meal. Where it is observed that the birds are leaving any one particular grain, this should be given in a reduced quantity. It is a good plan to give more at this meal than the birds require. Then, with the grain being fed in deep litter, the birds will be induced to exercise in the early morning, and thus keep warm. Exercise is an essential for the maintenance of good health and a heavy egg-yield.

Do not forget green stuff, such as chaffed lucerne, clover, watercress, &c.

To sum up, draught-proof houses (but with an abundance of fresh air) kept in a thoroughly clean condition and providing ample accommodation, well-sheltered runs, green feed, clean water, grit, and a generous supply of food (with a proportion of animal matter) are indispensable if the pullets are to do their best. In view of the present rising egg-market it will pay to give the pullets the best possible care and attention.

THE BREEDING-COCKERELS.

It is now full time that the final selection of cockerels should be made for next season's breeding-pens. In connection with this important work the necessity of choosing only birds of undoubted constitution cannot be overstressed. A specimen may exhibit good type, size, breed-points, &c., and have ever such a pedigree of performance behind it, but if there is the slightest evidence of a weak constitution it should be rejected. Constitution should certainly be given the first consideration, but laying-type, size, breed-points, and a knowledge of the birds' ancestors must also be taken in conjunction. Never be tempted to pick as a sire a very early maturing specimen, as such seldom or never grow to a desired size. To mate such stock invariably means a weedy progeny and unsatisfactory egg-production. It should be ever remembered that the male is more than half the flock, and that if profitable progeny are to be produced none but the best males should be bred from. When the final selection of the best specimens has been made, they should be provided with a free range under the most natural conditions possible. The latter point is one of the secrets in building up bodily vigour. As to the work of selecting breeding-stock, the novice would be well advised to secure a copy of the "New Zealand Utility-poultry Standards," and to follow the plates and particulars contained therein. A thorough study of this work will serve as an excellent guide to the desired type of bird—both male and female—to retain for breeding purposes. In addition, it will enable the novice to select the most desirable specimens for the utility classes at poultry shows. Copies of the Standards are obtainable from the Publisher, Department of Agriculture, Wellington, at a cost of 3s. each, postage free.

GEESE AND GANDERS.

A correspondent wishes to know how he can distinguish ganders from geese. Unless a person has had experience this often proves a difficult matter. The size of the neck gives some indication, being thicker in the male than the female, while the former is usually larger in body and presents a more masculine appearance. The sex may also be distinguished by shutting up the geese in a shed and bringing a dog in. The geese will usually lift their heads up and go to the back of the shed, while the ganders will lower and stretch out their necks, hissing all the time. In the case of Emden geese, the goslings when hatched are yellow. Some, however, are hatched with a grey tinge on their down. It is claimed that the grey ones are geese, and that the bright-yellow ones invariably prove to be ganders. This theory is, however, not accepted by all.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

PREPARATIONS FOR WINTER.

As the honey-flow is now definitely over for the season, and the extracting finished, the next work is the preparation of the bees for the winter. It is assumed that in most cases sufficient stores have been left in the hives. From 30 lb. to 40 lb. will be required to tide the bees over the winter and early spring. If sealed combs of honey from clean colonies are not available colonies that are short of stores should be fed as soon as possible with syrup composed of equal parts of sugar and water. It is better to feed heavily now where necessary than to wait until the bees have used up their meagre stores. The bees cannot leave their cluster during the cold months of winter and early spring to take down any syrup that may be offered them, or generate sufficient heat to evaporate any surplus moisture it may contain. It is not recommended to feed sugar syrup, but it is necessary in the absence of sealed honey stores, as there is a risk of introducing disease with the feeding of honey unless it is definitely known that the apiary from which it was obtained is quite free from foul-brood and has been so for some years. It is generally admitted that honey-fed bees have a better constitution than those fed with sugar, and will build up better in the spring. There is also reason to believe that some sorts of honey are better than others, but we have no definite proof. There is a marked difference in the specific gravity of our honeys.

The entrances of all colonies should now be reduced. The average colony will require an entrance 3 in. to 4 in. wide. If the entrance is more than $\frac{5}{16}$ in. high, this, too, should be reduced in order to prevent mice getting into the hive.

When stacking away the supers of combs for the winter place a sheet of newspaper between each super, and a roof or its equivalent on top to keep out mice and wax-moths. Pack away any foundation that may be left over in a light and air-proof box. It will become very brittle if left exposed to the atmosphere.

Keep a sharp lookout for foul-brood, and, if discovered, deal with it at once by one of the methods recommended last month, or destroy the colony. It does not pay to risk its spreading by robbing during the winter.

If robbing sets in, place a strip of wood in which an escape has been fitted across the entrance of the colony that is being robbed, and leave it until after sunset. Then reduce the entrance to not more than 1 in. in width.

WEAK AND QUEENLESS COLONIES.

Queenless colonies should be disposed of by uniting them with strong queen-right colonies. This is most readily accomplished in the evening when all field-bees have returned. After taking the roof and mat from the queen-right colony, place a sheet of newspaper immediately over the top of the frames and carefully place the queenless colony on top. No smoke will be required if the hive is handled gently. Weak colonies should be similarly united if the queen is of little value. If the queen is young, brood-rearing will probably be kept up for some time, and such colonies, though weak, will probably be worth saving. This is best accomplished by shifting them into a small hive, called a nucleus box, large enough to take only four frames.

—*H. W. Gilling, Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

Current Work.

SEEDS of an early variety of cabbage and lettuce for earliest use should have been sown a month ago. A larger kind of cabbage to succeed the early variety, cauliflower, onions, and more lettuce can now be sown. The cabbage sown last month should have been a true early Flower of the Spring type. These varieties produce very small heads. The plants should be set out in rows about 18 in. apart and 12 in. apart in the rows. The stumps should be pulled out when the heads are cut. The larger kind to be sown at the present time will require more space. In home-garden practice the stumps of these kinds may be left to produce sprouts. The sprouts make a better-flavoured vegetable than the first head. Sprouts are freely produced through summer and autumn, and will really carry on till the next spring crop is ready, giving a long succession of sprouts without labour. Of course, this plan is not suitable for market-gardening. Two kinds of cauliflowers should be sown, Snowball, Early London, or Early Paris for first use, and an Autumn Giant type to succeed the early.

Onions: Where it is desired to grow the Giant kinds seeds must be sown at once, these kinds being transplanted in spring. In districts where mildew is troublesome it is a good practice to sow keeping kinds also at this time. The advantage is that autumn-sown crops mature earlier than those sown in spring, ripening before mildew usually appears, or at least being so far advanced that mildew does little harm. The disadvantages are that the bulbs are likely to be rather large, and they do not keep so long as spring-sown bulbs. Some growers sow onions where they are to grow, others transplant. The latter plan is usually best, as fewer plants will bolt to seed. The former plan is practicable only on clean soil. If beds of any size became badly infested with weeds it would be impracticable to clean them, as it would have to be done by hand-weeding.

Turnips: If the winter crop has not been provided for it should be attended to at once, on the lines indicated last month.

Celery: Heads that have reached usable size should be moulded up. The heads will keep sound for a long time when thus treated, as they are protected from rain. Before moulding up remove any side sprouts there may be. Draw the stems together so as to keep soil from the hearts. Pack the soil firmly round the base of the heads to prevent sinkage, which might cause a bend in the stems and impair quality. Moulding-up should not extend beyond the solid

stems; a good amount of leafage should project above the soil. If too much of the green tops are covered the leaves may rot, and this may extend down into the stems, and heads be lost.

Green manuring: Vacant land should be put down to a cover-crop to supply humus. For this purpose lupins, rye, partridge peas, Cape barley, or white mustard may be used—whichever has proved best for the locality. In the colder districts probably mustard will do best, as it takes but a short time to grow.

Tomato Practice.

In an article on black-stripe disease, which appeared in last month's *Journal*, it is advised that where stable manure is applied to the soil a crop such as cabbages should be taken from the ground before tomatoes are planted. There is evidence of the efficacy of this plan. Some growers, however, now state that it does not do to plant tomatoes after cabbages. This conflicting evidence is easily explained. It depends very much on the quantity of cabbage-leaves ploughed in. If the quantity is large, bad effects are likely to follow, and if the stumps are also ploughed in, as is often the case, trouble is the more likely to result. In garden practice the stumps of cabbages and similar plants should be dried and burned, except that where the land is being trenched there is no harm done by burying them at the bottom. The danger from cabbages lies in the excess of green vegetable matter, but probably this is not harmful to crops other than tomatoes. The case of lettuces is quite different. This plant is likely to be affected by two diseases—rhizoctonia and sclerotinia. These also affect many other plants; but the lettuce, being the most susceptible plant and also because its bottom leaves are close to the soil, affords the most favourable conditions for the propagation of diseases, especially sclerotinia. This may be the cause of infection in other plants. Any plants that wilt or show signs of rot should be regarded with suspicion. They should be removed and buried deeply in the ground where they will not be disturbed again.

—*W. H. Taylor, Horticulturist.*

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 3rd March: *Peas*—Consumption restricted. New Zealand blue, on spot, selling slowly at 75s. to 79s. per quarter; buyers not bidding for shipments. Tasmanian offered, afloat, 87s. 9d.; buyers 83s. 6d. to 85s. New Zealand maple, spot values 105s. to 110s. per quarter; sellers offer February–March shipments 75s., March–April shipments 72s. 6d.; buyers 71s. Trade not active. *Beans*—Small trade. English supplies plentiful at 200s. per ton. Little inquiry for imported. Chinese offered at 190s. per ton. New Zealand prices nominal, 50s. to 52s. per quarter.

Noxious Weeds.—The Taumarunui County and Heathcote County have declared the following plants to be noxious weeds in the respective districts under their jurisdiction: African boxthorn; barberry; Bathurst burr; broom; burdock; Cape honeyflower; Capeweed or Cape daisy; cut-leaved psoralea; dock; elderberry; fennel; foxglove; giant burdock; goat's rue; gorse; hakea; hemlock; Japanese wineberry; kangaroo acacia; lantana; lupin; ox-eye daisy; pennycress; pennyroyal; periwinkle; prickly pear; spiderwort; St. John's wort; tauhinu; thistles (any species of stemless thistle, common plume or Scotch thistle, woolly-headed thistle, star thistle, and milk-thistle); tutsan; viper's bugloss wild borage; wild turnip; winged thistle. Masterton County has similarly declared broom, and Opotiki County Japanese wineberry.

Manurial Value of Whey.—Several inquiries have been received recently on this subject. The ash of whey contains somewhat less than one-third of its weight of phosphoric acid and a similar amount of potash, but there is only six-tenths of a part of ash in every hundred parts of the whey. The manurial value due to the mineral ingredients is therefore extremely small. There may, however, be a considerable indirect manurial value in the following manner: The soil bacteria are stimulated by solutions of sugars, and whey contains about 4½ per cent. of milk-sugar. It is quite possible that on some soils whey would have a beneficial effect, but whether it would be economical to use it in this manner can only be determined with a knowledge of all the circumstances of the case. Speaking generally, the most economical utilization of this by-product (in districts where sugar of milk is not manufactured) is as a pig or other stock food.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

VAGINITIS IN COWS.

A. B., Kamo :—

Last season a great many of my cows aborted, and they do not appear to be getting in calf this year. When in season I notice a slight discharge of blood whether they have been served or not. Last year several cows came back to the bull regularly, but proved to be in calf all the time. I have syringed the cows carefully with permanganate of potash, and also with carbonate of soda, just before service, but they do not seem to be holding. Can you advise a remedy ?

The Live-stock Division :—

We are of opinion that your herd is affected with abortion disease, giving rise to the abortions last season. However, from the symptoms you describe, it is evident that the cows are now suffering from vaginitis (inflammation of the vaginal passage). This condition is contagious and may be spread by the bull. As regards treatment, we have had good results from the use of sulphocarbolate of zinc, used as a vaginal douche at a strength of 1 dram dissolved in a quart of hot water and cooled to blood-heat. The cows should be washed out with this every second day for a fortnight. Some long-standing cases do not yield readily to treatment. Keep the affected cows separate from the healthy. Remove the bull if he is running with the cows, and wash him also with the same solution. While under treatment the cows should not be served.

CASTRATION OF HORSES.

" LEARNER," Rissington :—

Will you please give me some information on castration of horses ? I can tie them down, but am not an expert with the knife.

The Live-stock Division :—

The animal should be fasted for at least twenty-four hours prior to the operation, but water should be available. After the horse has been thrown and secured on his back, the sheath and scrotum should be well washed with a warm antiseptic solution and dried with a soft cloth. The operator stands directly behind the animal and, grasping one testicle firmly, renders the skin over it tense. Next a bold longitudinal incision should be made through the skin, when the testicle should appear through the wound. The testicle may be removed by any of the emasculative instruments. The operation is repeated on the other testicle, and the horse allowed to rise. Care must be taken that there is no rupture present before operating. The operation can be more easily understood if it is once seen performed by a capable man.

CONTAGIOUS MAMMITIS AND INFECTION.

" MAMMITIS," Waitahuna :—

Can you tell me if a cow which has contagious mammitis and is dried off is likely to infect others with whom she is running ? If she had another calf and was allowed to suckle it would it grow up a healthy animal ?

The Live-stock Division :—

There is no likelihood of a cow suffering from contagious mammitis and subsequently dried off infecting others running in the same paddock. If she were to have another calf and rear it there would be no danger of the calf becoming infected, as the quarter would, in all probability, be dried off.

COW WITH CATARRH.

"CATARRH," Albany :—

Could you advise me how to treat a cow suffering from catarrh ? Her eyes and nose are constantly running, and the trouble seems to irritate her nose a great deal, as she is constantly rubbing it, very often making it bleed.

The Live-stock Division :—

A careful examination of the nose should be made to determine if any foreign body—piece of wood, brier, &c.—has become fixed there, setting up the irritation. If nothing of this nature can be found, you might try syringing each nostril daily with a solution made by dissolving 30 grains of sulphate of zinc in a pint of water. The eyes should be bathed with a lotion made by dissolving a teaspoonful of boracic acid in a cupful of warm water.

GREASY HEEL IN HORSES.

H. HARGREAVES, Karamea, Westport :—

Please inform me whether greasy heel in horses is a contagious disease.

The Live-stock Division :—

Greasy heel is a diseased condition, principally in that region of the pasterns of horses in which the oil-glands (which secrete oil to keep the part flexible) are involved, and it is not contagious. The predisposing causes of this disease are many, and include the influence of constant dampness, the trouble occurring in horses grazing on swamps or working in soft muddy ground when the mud is allowed to accumulate and is not brushed out daily when dry. Digestive derangements and weak circulation are also predisposing causes. As the disease advances, fungi and micro-organisms of various kinds are found present, and though they tend to aggravate the trouble they have not so far been proved essential factors in causing the disease.

HEIFER WITH DRIPPING TEATS.

"SUBSCRIBER," Okoroire :—

I have a three-year-old heifer just calved, and its two back teats drip milk continuously. Would rubber bands prevent this ?

The Live-stock Division :—

There is no reliable preventive for the trouble you describe. Rubber bands would have to be so tight that the circulation would be interfered with, and this is undesirable.

REDWATER IN CATTLE.

"REDWATER," Mangamaire :—

Will you please let me know if feeding cows on swedes or turnips will cause redwater ? What are the recognized causes of this complaint, and the treatment for it ?

The Live-stock Division :—

Redwater in cattle is usually caused by too lavish and too constant feeding on roots. The usual symptom is a red colouration of the urine. The following treatment is recommended : Give the affected animal 1 lb. common salt in 4-oz. doses at four-hour intervals. Remove the animal from roots altogether for a time, placing it in a fresh pasture, and giving hay, bran mashes, linseed mashes, &c. After the bowels have moved freely from the salt drenches, give one of the following powders night and morning in a bottle of gruel : 2 drachms ferri carb. sacch., 1 oz. cinchona, 2 drachms gentian.

COWS RETURNING TO BULL.

F. HALL, Edendale :—

Can you give a reason for cows returning to the bull every three weeks for two or three periods and then getting in calf ? The cows were douched with Jeyes Fluid (1–60) after calving.

The Live-stock Division :—

Failure of conception in cows may be the result of a number of conditions, and in the absence of particulars or an examination of the animals it is difficult to say exactly what may be the cause in your case. As conception occurred after the second or third visit to the bull it is probable that at the earlier periods an undue acid condition of the genital passage has existed which spontaneously disappeared later. This condition has a devitalizing effect on the spermatozoa, and prevents conception by retarding their activity. An alkaline douche, made by dissolving 5 oz. of baking-soda in ½ gallon of water, used shortly before service, is in most cases followed by good results. Retention of the afterbirth, with the consequent septic discharge from the womb, will also account for failure to conceive, especially at the first or second period of oestrum. The fact that the bull may be at fault should not be overlooked. This frequently occurs where he is turned out with the herd, a state of temporary impotency being brought about by overwork.

ROARING IN HORSES.

R. S., Murchison :—

Would you kindly inform me if there is any cure for a roaring horse ? The symptoms in this case are as follows : After pulling for a distance the animal (a mare) nearly chokes ; the noise she makes is like that made by a Paradise duck, and seems to be in the windpipe, being worse at some times than at others. When spelled for a moment she makes a couple of belching noises and then ceases roaring.

The Live-stock Division :—

True " roaring " in horses is caused by paralysis of the left vocal cord in the larynx. The larynx is situated at the top of the windpipe between the two branches of the lower jaw. The noise is caused by the vibration of the vocal cord when the animal expires (breathes out). The only treatment for true roaring is an operation which is not always successful in removing the noise, nor is it always successful in restoring the animal's usefulness. It is needless to say that the operation can only be performed by a qualified veterinary surgeon who has a thorough knowledge of the anatomy, &c., of the region of the throat. Very often horses make a noise when pulling, and this noise is made when the animal inhales (breathes in); but the noise can also be heard on exhaling. This is caused by a badly fitting collar. The bottom of the collar presses on the windpipe, thereby constricting the lumen of the windpipe and causing a state of partial suffocation through the animal being unable to take in sufficient air to purify the blood. The same thing may happen when the throat-lash of the bridle is buckled up tight so that the windpipe or larynx is compressed. Again, if a horse's nose is drawn into the chest, as when a tight bearing-rein is used, the opening at the end of the windpipe through which the air passes is constricted and a noise is caused, while the horse, when pulling hard, partially suffocates and stops in his work. Another cause of horses making a noise is on account of growths, commonly polypi (narrow-based tumours) in the nose or back of the throat. The only treatment for these is a surgical removal by a veterinarian. If the noise is caused through pressure on the windpipe by the throat of the collar, a collar must be used which has room for the hand to be placed between the windpipe and the throat of the collar when the animal is pulling.

NOTICE.—An answer cannot be given to " L. J. S.," Poukawa, regarding grubs in loganberries, unless the full name is supplied. See general notice under heading of " Answers to Inquiries."

WEATHER RECORDS.

FEBRUARY, 1923.

THE following general summary and rainfall statistics are supplied to the *Journal* by the Director of the Dominion Meteorological Office (Mr. D. C. Bates) :—

The month opened with stormy weather, on account of the passing of a cyclone northward of the Dominion. Easterly gales and heavy rain were experienced in the north. Barometric pressure quickly recovered, but an extensive westerly low-pressure held sway over the Dominion between the 5th and 10th, with heavy rain in the west coast and southern districts, while warm and sultry conditions ruled in the east coast until the change took place with the wind backing to south-west on the 9th. This brought thunderstorms along the east coast. High pressure continued in the north from the 8th to the 13th, but from the 14th conditions were very unsettled everywhere, and changeable and showery weather prevailed until the end of the month. A cyclonic storm passed northward of the Dominion on the 28th.

Rainfall was mostly in excess in the west coast and southern districts of both Islands, but great diversities are apparent in the returns for the month. For instance, while Foxton was 74 per cent. above the average, Wellington was 54 per cent. below; New Plymouth was 25 per cent. and Inglewood 12 per cent. below; Whangamomona was 35 per cent. and Patea 57 per cent. above. Invercargill had over three times the average for the month; and Gore and Queenstown were each 123 per cent. above the mean for the month of former years. Rainfall was rather deficient on the east coast of the North Island and on some of the highlands in the South, but it was in excess on the highlands in the North.

RAINFALL FOR FEBRUARY, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
	North Island.			
	Inches.		Inches.	Inches.
Kaitaia	0·58	3	0·30	2·95
Russell	1·82	5	1·16	4·35
Auckland	3·84	12	1·82	2·97
Hamilton	2·94	11	1·15	2·85
Kawhia	3·48	9	1·10	2·40
New Plymouth	3·08	15	1·34	4·09
Inglewood	5·63	17	1·44	6·40
Whangamomona	5·60	19	1·02	4·14
Tairua, Thames	2·74	5	2·40	4·52
Tauranga	2·55	7	1·55	3·62
Maraehako Station, Opotiki	2·76	7	2·16	3·70
Gisborne	2·28	6	1·07	3·68
Taupo	3·66	6	1·54	2·81
Napier (Park Island)	2·78	7	0·62	3·02
Taihape	4·20	12	1·20	2·43
Masterton	3·54	12	1·40	2·71
Patea	3·66	13	0·82	2·33
Wanganui	3·19	4	1·50	2·49
Foxton	2·87	8	1·35	1·65
Wellington	1·47	14	0·58	3·23
	South Island.			
Westport	6·46	20	0·98	4·37
Greymouth	7·29	21	1·21	6·13
Hokitika	9·62	20	2·30	7·29
Arthur's Pass	12·48	14	2·40	7·55
Okuru, Westland	14·76	18	2·84	7·92
Collingwood	3·82	11	1·24	5·63

RAINFALL FOR FEBRUARY, 1923—*continued*.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Nelson	1·16	8	0·56	2·78
Spring Creek, Blenheim	1·56	7	0·45	2·30
Tophouse	4·14	14	0·88	4·50
Hanmer Springs	2·72	9	0·80	2·93
Waiau	2·56	10	0·84	2·55
Gore Bay	3·75	10	1·40	3·50
Christchurch	2·06	9	0·46	1·84
Timaru	2·02	16	0·34	1·89
Lambrook Station, Fairlie ..	1·01	7	0·32	1·95
Benmore Station, Omarama ..	0·86	11	0·16	1·23
Oamaru	3·20	9	1·08	1·72
Queenstown	3·92	12	0·66	1·76
Clyde	0·77	7	0·20	0·99
Dunedin	5·19	18	1·07	2·70
Gore	5·52	22	0·61	2·47
Invercargill	8·86	23	1·36	2·73

NOTE.—The following January rainfall figures were received too late for insertion in last month's *Journal*: Napier—Total fall, 8·10 in.; number of wet days, 17; maximum fall, 1·34 in.; Gore—Total fall, 3·50 in.; number of wet days, 17; maximum fall, 0·61 in.

TENURE OF LAND OCCUPIED IN NEW ZEALAND (excluding Boroughs): 1921–22.

Land District.	Freehold occupied by Owner.	Leased from Private Individuals.	Leased from Public Bodies.	Leased from Maoris.	Crown Leases and Licenses under various Tenures.	Total Area occupied.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
North Auckland	2,392,712	103,548	25,514	79,778	401,353	3,002,905
Auckland ..	2,829,700	137,816	47,297	455,675	1,026,828	4,497,316
Hawke's Bay ..	2,718,351	237,236	105,502	600,459	889,477	4,551,025
Taranaki ..	897,747	167,453	57,572	90,887	501,952	1,724,611
Wellington ..	3,267,988	378,750	83,220	450,423	755,601	4,935,982
Nelson ..	619,121	53,492	7,320	14,429	638,530	1,332,892
Marlborough ..	811,702	56,014	9,254	19,419	1,592,460	2,488,849
Westland ..	172,689	20,381	6,203	3,951	1,527,825	1,731,049
Canterbury ..	3,144,360	343,872	282,880	9,426	4,333,606	8,114,144
Otago ..	1,630,096	173,123	117,540	7,569	6,006,512	7,934,840
Southland ..	1,450,056	102,031	144,647	5,813	1,512,177	3,214,724
Totals, 1921–22	19,934,522	1,773,716	886,949	1,737,829	19,195,321	43,528,337
Totals, 1920–21	19,671,255	1,796,033	793,566	1,750,805	13,372,206	43,546,757

A farmers' course of instruction will be held at the Central Development Farm, Weraroa, from 30th April to 5th May next, on similar lines to those of last year's school. Applications for enrolment should be addressed to the Farm Manager, who will also supply any further information required. A moderate charge will be made for board. Early enrolment is advisable.

CUTTING OF CALIFORNIAN THISTLE.

IN view of certain statements that Californian thistle is checked far more effectively when cut in flower than is the case with earlier cutting, the Department recently carried out tests on selected areas in Canterbury. Cutting at the respective stages was done last season, and the results, after the lapse of a year, have now been duly observed and recorded. Neither area gives any indication that late cutting results in the reduction of the thistles, there being no apparent difference between the late and early cut patches. Taking everything into consideration, including the obvious risk of allowing the thistle to flower, the Department cannot endorse the method of late cutting.

A SHEEP-FARMING HANDBOOK.

THE latest of Messrs. Whitcombe and Tombs's series of Practical Handbooks to appear is "Sheep-farming in New Zealand," by William Perry, with contributions by other specialists. This is a branch of our agriculture whose treatment in simple book form has really been long overdue. The publishers of the present work have been well advised in their selection of principal author, Mr. Perry, the well-known studmaster of "Penrose," Wairarapa, being exceptionally well qualified for the part. The little volume is written primarily for the young farmer, whom it takes through the various phases of the subject, from choosing and equipping a sheep-farm, breeding, management, and feeding, to the preparation of the clip for sale. The book, however, will also be useful to a wider circle, and the discerning reader of experience will appreciate Mr. Perry's intimate touch in many places. The volume, which includes a number of photo illustrations of stud-sheep of various breeds, is bound in cloth, and is issued at the price of five shillings.

"CURE-ALLS" FOR LIVE-STOCK.

IT is remarkable how gullible many persons are when approached by agents or canvassers of some preparation reputed to be a cure for almost any ill that animal flesh may be heir to. So-called "cure-alls" are constantly on the market, and are too often found on the shelf of the farmer, who, unfortunately, looks upon the purchase as a guarantee or insurance against any of the troubles to which his stock may become afflicted, and in time of trouble relies on such preparations—often to his future sorrow. Numerous cases have come under the Department's notice of very serious loss having occurred through too great reliance being placed on such preparations, and it is hoped that this note may serve as a warning to stockowners to look with suspicion on any preparation reputed by the canvasser to be a cure for this, that, and the other ill. A little thought should brand any such assertion as ridiculous, seeing that each trouble has its own peculiarity, and therefore its own particular treatment.

FORTHCOMING WINTER SHOWS.

Auckland A. and P. Association: Auckland, 1st to 8th May.

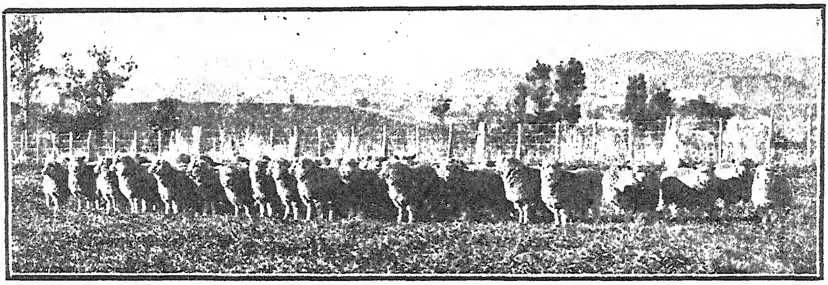
Waikato Winter Show Association: Hamilton, 29th May to 4th June.

Otago A. and P. Society: Dunedin, 5th to 8th June.

Taranaki Metropolitan Agricultural Society: New Plymouth, 6th to 9th June.

Manawatu A. and P. Association: Palmerston North, 19th to 22nd June.

(Agricultural and Pastoral Association secretaries are invited to supply dates and location of their shows.)



The New Zealand

Journal of Agriculture.

Vol. XXVI.—No. 4.

WELLINGTON, 20th APRIL, 1923.

TESTING OF PUREBRED DAIRY COWS.

THE NEW ZEALAND C.O.R. SYSTEM IN 1922.

W. M. SINGLETON, Director of the Dairy Division.

THE improvement of dairy herds received a large measure of attention in the dairying districts of New Zealand during 1922. Necessity for such improvement has continued to be manifested to our dairy-farmers as a result of the lowering of their receipts since the war period in much greater proportion than they have been able to reduce the increased costs of production. The marked development in herd-testing during the present season—some 80,000 cows being on association test, as compared with 45,564 in 1921–22—affords strong evidence that the farmers are studying methods of improvement.

New Zealand is even now a comparatively new country from the dairying standpoint, and there are still great areas to be brought in for the purposes of the industry. Until our pastures are further improved, and aided to a greater degree by supplementary feed, the average cow cannot do herself justice. Moreover, as the Dominion is largely extending its grasslands each year, the dairy-cow population has to be correspondingly increased. In the last five years such increase has been some 46 per cent. This means that culling cannot be so stringently carried out as would be the case were the number of cows remaining

fairly stationary. Later on, as more stable conditions are reached in this respect, we may expect to see more uniformly steady progress made in the improvement of our average cow. In the meantime much good work is being accomplished both by culling on test and building up the herds through breeding better heifers to replace the culls.

While more attention is being given to the use of purebred sires for the dairy herds, there is still need for much sustained effort in impressing on the average dairyman the importance and advantages of this practice. The certificate-of-record testing system is undoubtedly doing a great deal in this respect. The agricultural Press of New Zealand has also given the movement faithful support, and much other work is being carried out on educational lines. All things considered, we may expect to see important developments in the future.

INCREASE IN TESTING FEES.

When dealing with the matter of fees in the last annual review of the C.O.R. system the rise to five guineas was mentioned, and it was also hinted that the breeder testing only one or two cows might be called upon to pay heavier fees. This was found unavoidable, and from 1st April, 1922, the rule regarding testing fees was reconstructed to read in part as follows :—

> For the first cow or heifer to be tested on one farm and commencing test after 1st April of each year the fee shall be ten guineas, and for each subsequent cow or heifer commencing test within that same year the fee shall be three guineas : Provided that a period of not more than six months shall elapse between the date of calving of the first and last cow or heifer entered.

It was anticipated that this would tend to increase the number of cows entered by each breeder, so that the lower cost per cow after the first would be taken advantage of. That this view was correct has been borne out by the relationship this season between the number of testing breeders and the number of cows tested. Our records show for the maximum month 280 breeders testing 1,061 cows, which is an increase over the 1921–22 season of 250 cows and a decrease of twenty-nine breeders. This signifies, of course, that the cost per cow to the Department is more closely met than previously, and it is now hoped economic conditions will be such as to enable the Government to continue the service to breeders without further increase of fees. It is pleasing to record that the change has met with a minimum of dissentients.

EXPORT OF PUREBRED DAIRY CATTLE.

The export of purebred dairy cattle continues, and during the calendar year 1922 some 115 head, valued at over £8,500, have been exported, mainly to Australia and Fiji. Many of these animals have been among our best dairy stock, and while in some respects New Zealand cannot afford to lose them, we trust they will become progenitors of good stock under their new ownership.

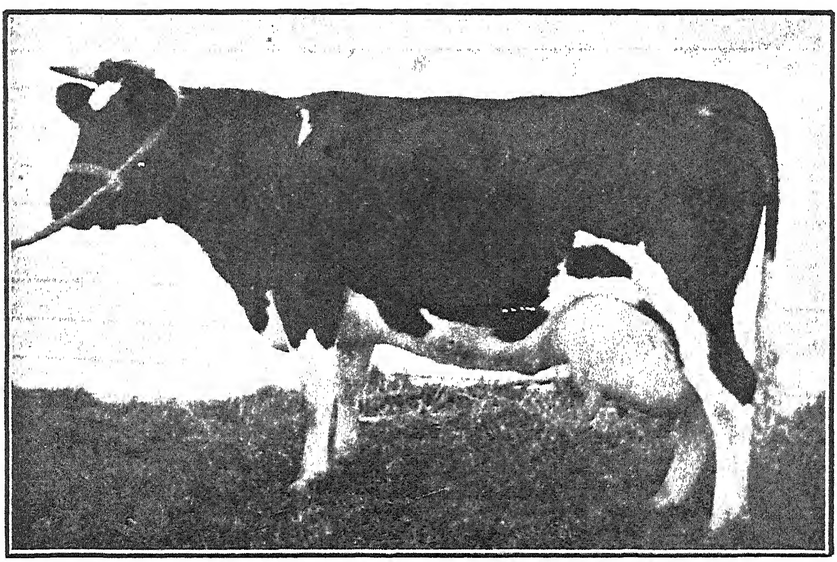
CERTIFICATES ISSUED.

The total number of cows which have received first-class certificates since the commencement of the certificate-of-record testing system has now reached 2,695. In 1922 there were issued 543 ordinary first-

class certificates, and eighty-eight certificates on repeat records. These increases are not so large as those for the previous year, and this may in part be accounted for by the rise in fees from three guineas to five guineas per cow, commencing in January, 1921. During the year under review certificates were issued to five Shorthorn cows as distinct from Milking Shorthorns. The five cows referred to are registered in the New Zealand Shorthorn Herd-book published by the New Zealand Shorthorn Cattle Breeders' Association, Christchurch.

The following table gives particulars of certificates issued since the commencement of the system :—

Breed.	1913.	1914.		1915.		1916.		1917.		1918.		1919.		1920.		1921.		1922.	
		Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.
Jersey ..	67	104	14	91	4	94	11	94	13	113	8	150	14	227	33	339	49	351	46
Friesian ..	48	67	11	62	9	44	5	62	14	57	14	54	7	82	23	127	25	136	32
Milking Shorthorn	..	..	..	2	..	7	..	21	..	22	..	53	3	59	2	31	6	25	2
Ayrshire..	2	15	1	12	1	9	..	4	4	4	..	2	..	5	..	10	1	18	5
Red Poll	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	7	8	3
Shorthorn	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	..
Totals..	117	186	26	167	14	154	16	181	31	196	22	259	24	373	58	519	88	543	88



OAKWOOD BETTY (W. D. HUNT, BAINFIELD, INVERCARGILL).

C.O.R., 1922 : 5 years 9 days ; in 365 days, 21,748 lb. milk, 810·11 lb. butterfat.

JERSEYS.

Class-leaders.

While the Jersey breed has added during the year many excellent certificates to its fast-lengthening list, there is only one change of class-leader to report. In the four-year-old class Mrs. A. Banks and Son's Woodstock's Fancy Free (770·35 lb. butterfat) has given way to Mr. A. J. Smith's St. Lambert's Bell, who, commencing test at 4 years 283 days, has gained a certificate on a yield of 780·32 lb. butterfat. This cow has been on test previously, when, as a senior two-year-old, she produced 470·34 lb. butterfat. The sire of St. Lambert's Bell is Soumise Tom, sire of eight certificate-of-record daughters, two of whom (in addition to St. Lambert's Bell) have received certificates for production exceeding 700 lb. butterfat. Soumise Tom was sired by Soumise Majesty, who has nine certificated daughters on the dam's side. In these pedigrees there appear many names which have played a prominent part in the making of the Jersey breed in New Zealand, and St. Lambert's Bell would seem the product of several generations of successful breeding lines. Not only does her record constitute a class-leadership, but it is the highest Jersey yield for the year.

The list of class-leaders for 1922 is as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb,
Aster's August Child	James Nicholson, Kaupokonui	1 337	240·5	365	11,498·5	689·05
Senior Two-year-old.						
Lady Superior ..	John Hale, New Plymouth	2 183	258·8	365	9,975·5	680·33
Three-year-old.						
Woodstock's Baby ..	Mrs. A. Banks and Son, Kiwitea	3 302	307·2	365	12,329·7	657·91
Four-year-old.						
St. Lambert's Bell ..	A. J. Smith, Cardiff ..	4 283	341·8	365	14,423·1	780·32
Mature.						
Sultan's Daisy ..	E. O'Sullivan and Sons, Tariki	6 344	350·0	365	13,502·7	668·22

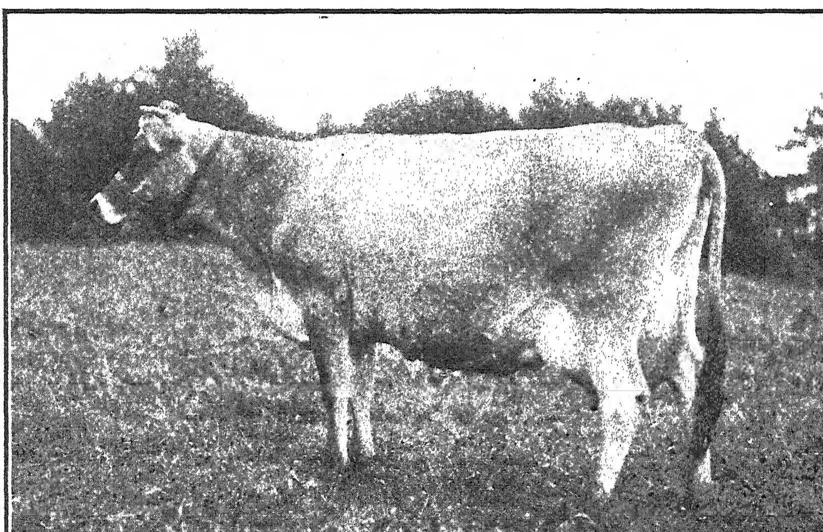
Jersey Class-averages.

The Jersey classes in 1922 comprise 397 certificates, as against 388 for the previous year. Apart from the junior two-year-olds, which show an increase in numbers of twenty-five, the classes numerically are much the same as in 1921. We are able to report a marked increase in the average production for each class, and this may be considered a creditable achievement. It is interesting to record that of the 176 junior two-year-olds included in the average no less than ninety-three (more than half) had the minimum butterfat requirement of 240·5 lb.—that is, commenced their test at two years of age or under. The maximum standard for the class is only 249·7 lb., so that an average yield of 390·17 lb. in an average lactation period of 342 days is clear

evidence of the fact that the young stock of this breed may reasonably be expected to develop some heavy producers. The average certificate-of-record Jersey for 1922 produced 443·75 lb. butterfat from 8,007·5 lb. milk in 344 days. Since the commencement of the system in New Zealand 1,822 certificates have been issued to Jersey cows, and the records represented average 7,572·57 lb. milk and 420·21 lb. butterfat in 342 days. The average test works out at 5·55 per cent.

The figures for 1922, together with those for 1921 for purposes of comparison, are as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1922.		lb.	lb.
Junior two-year-old ..	176	342	6,950·4	390·17
Senior two-year-old ..	41	350	7,815·2	427·75
Three-year-old	57	337	8,342·8	462·10
Four-year-old	37	348	8,869·7	498·37
Mature	86	349	9,669·5	525·38
	1921.			
Junior two-year-old ..	151	342	6,281·1	351·37
Senior two-year-old ..	35	336	6,825·8	383·39
Three-year-old	55	332	7,620·3	430·67
Four-year-old	50	343	8,147·0	467·80
Mature	97	340	8,686·5	478·39



ST. LAMBERT'S BELL (A. J. SMITH, CARDIFF).

Leader of the Jersey four-year-old class. C.O.R., 1922: 4 years 283 days; in 365 days, 14,423·1 lb. milk, 780·32 lb. butterfat.

Jersey C.O.R. Bulls.

During 1922 twenty names were added to the list of Jersey certificate-of-record bulls (such bull being one who has sired at least four certificated daughters, each from a different dam). This now makes a total of 102 names, with 768 certificate-of-record daughters.

Of the bulls which have qualified during the year the name which first catches the eye is Grannie's Knight, because of the fact that no less than thirteen of his daughters were granted certificates during that period. His sire is K.C.B., who stands out as one of the pioneer bulls of the breed in New Zealand, and his dam is Grannie's Girl, a well-known Taranaki matron. His fourteen certificated daughters now include five two-year-olds with productions of over 500 lb. butterfat, which must be considered very meritorious.

Fancy's Lord Twylish has added another three daughters to his credit, and now, with Roberts, holds fourth place on the list. Among his daughters are Mere, with 663·64 lb. butterfat, which at one time constituted a world's class-record for the breed; Woodstock's Fancy Free, with 770·35 lb.; and Woodstock's Baby, with 690·16 lb. These performances and those of other daughters surely place Fancy's Lord Twylish among the leading bulls of the breed in the Dominion.

The list of bulls is as follows:—

Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1922.	Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1922.
Majesty's Fox ..	30	1	Bush Boy	8	1
Eminent's Fontaine ..	28	1	Molina's General ..	8	1
K.C.B.	26	0	Heather Boy ..	8	0
Fancy's Lord Twylish	19	3	Frisky Campanile ..	8	0
Roberts	19	0	Lord Twylish ..	8	0
Admiral of Puketapu	17	0	V.C.*	7	6
Noble Twylish ..	15	7	Exile of Oaklands ..	7†	0
Grannie's Knight* ..	14	13	Sunlight's Noble General	7	0
Belvedere Sun Prince	13	7	Blizzard	7	0
Bilberry's Goddington	12	0	Stevenson	7	0
Sunflower's Perseus ..	12	0	Goddington ..	7	0
Sultan's Disdain ..	12†	3	Brighton Twylish ..	7	0
The General ..	11	2	Petune's Noble ..	7†	0
Rainbow	11	2	Hawkesbury Emperor	7	2
Golden Swan ..	11	0	Bilberry's Twylish* ..	6	5
Good Luck ..	10	3	Mona's Ally* ..	6	4
Campanile's Sultan ..	10	0	Viola's Golden Laddie*	6	4
Lady's Duke ..	9†	0	Masterpiece of Meadowbrook*	6	3
Renown of Meadowbrook	9	1	Sweet Fox of Collingwood	6	2
Farleigh Fox ..	9†	1†	Golden Fox 2nd ..	6	1
Charm's Lord Twylish	9	0	Maid's General ..	6†	1†
M.L.C.	9	0	Grand Duke ..	6	0
Starbright	9	0	Pride of Egmont ..	6	0
Rozel's Sultan ..	9	0	Mabel's Dairyman ..	6	0
Soumise Majesty ..	9	0	Belvedere Butter Boy	6	0
Soumise Tom* ..	8	5	Marcus	6	0
The Owl's Victor ..	8‡	4	Belvedere Sunset ..	6	0
Peggy's Campanile ..	8†	3	Meadowbrook Nobility	6	0
Oculist 12th ..	8	2			
Mermaid Sultan ..	8	1			

JERSEY C.O.R. BULLS—*continued.*

Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1922.	Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1922.
Belvedere Bilberry's Last	6	0	Oakvale's Redline ..	5†	0
			Maid's Noble General*	4	4
Blondin*	5	5	Noble Warder* ..	4	3
Admiral*	5	3	Butterman Lad* ..	4	1
Holly Bank Squire* ..	5	3	Flandrine's Swan* ..	4	1
Rainbow's King* ..	5	3	Fairy's Campanile* ..	4	1
Protection of Meadowbrook*	5	2	Una's Nobility* ..	4	1
			Mayflower Magnet 2nd*	4	1
Miro Meadow's Maori Boy	5	1	Glory	4	0
			Young Emperor 3rd ..	4	0
Charm's Lord ..	5†	1	Fancy's Carnation Fox	4	0
Genoa Nelson Chase ..	5	1	Knight Commander ..	4	0
Silverlock's Duke ..	5	1	Yankee Sweet ..	4	0
Lord Nelson ..	5†	0	Nestor of Willowbank	4	0
The Squire	5	0	Starlight 2nd ..	4	0
Mona's Campanile ..	5	0	Flower Boy 2nd ..	4	0
Belvedere Jersey Boy	5	0	Melia Ann's Sultan ..	4†	0
Gavotte's Hero ..	5	0	Silver Conqueror ..	4	0
Juno's Laddie ..	5	0	Senor	4	0
Hawkesbury Black Prince	5	0	Black Swan ..	4	0
			Defender of Meadowvale	4	0
Twylish Hope* ..	5	4			
M.H.R.	5	0	Miro Meadow's Star ..	4	0
Silver King (Stuckey's)	5	0	Lord Maitland ..	4	0
Lord Lepperton ..	5	0			

* Qualified during 1922. † Also one second-class-certificate daughter. ‡ Also two second-class-certificate daughters.

FRIESIANS.

Class-leaders.

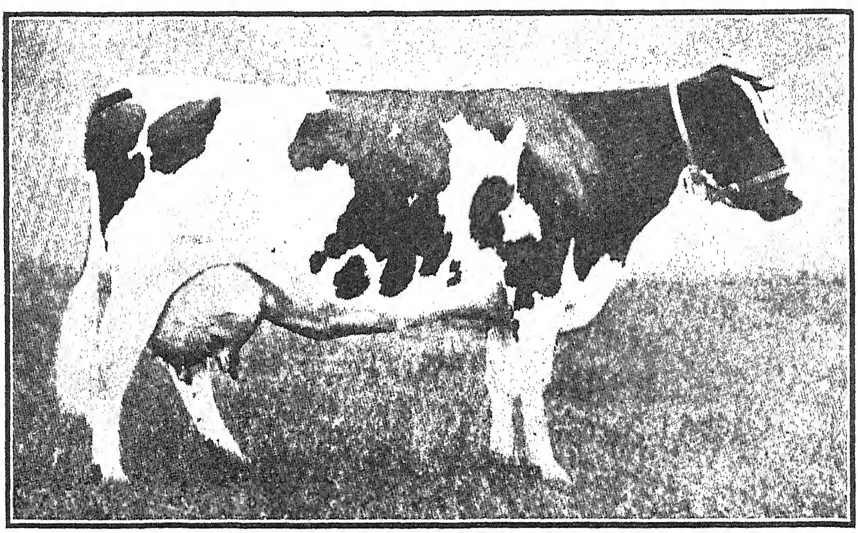
The certificates issued to Friesian cows during 1922 include two performances which raise the previous record for the respective classes. In the mature class Messrs. North and Sons' fine old cow, Burkeyje Sylvia Posch, with her splendid record of 983·20 lb. butterfat, has had to yield place to Mr. Vernon Marx's Alcartra Clothilde Pietje. This cow's performance, constituting her the milk and butterfat champion of New Zealand, was specially reviewed in the *Journal* for November last.

In the junior three-year-old class the production of Messrs. North and Sons' Rosevale Queen Daphne (675·18 lb. butterfat) has been replaced by the 800·18 lb. standing to the credit of Mr. T. H. Richards's Monavale Queen Bess. A glance at the appended table of Friesian class-leaders will show that a year ago this cow was on test as a junior two-year-old, when her performance constituted a record for that class. Monavale Queen Bess has certainly proved that her previous record was no freak, and she may now be considered as entitled to a place among the outstanding cows of the breed. Details concerning her breeding, &c., have been given in a previous number of the *Journal.*

The leaderships for the seven Friesian classes have now reached a standard of which the supporters of this breed may well feel proud.

While there are at present some excellent records in the making, it will be recognized that future changes must be slower in coming. The 1922 list is as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·10	740·50
Senior Two-year-old.						
Netherland Princess 4th	John Donald, Westmere	2 341	274·6	365	19,621·60	805·77
Junior Three-year-old.						
Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·30	800·18
Senior Three-year-old.						
Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·90	863·51
Junior Four-year-old.						
Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·00	939·78
Senior Four-year-old.						
Buttercup 3rd of Ashlynn	H. R. Green, Kairanga	4 305	344·0	365	20,694·25	833·26
Mature.						
Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·50	1,145·24



ALCARTRA CLOTHILDE PIETJE (VERNON MARX, MANGATOKI).

Leader of the Friesian mature class. C.O.R., 1922: 7 years 355 days; in 365 days, 31,312·5 lb. milk, 1,145·24 lb. butterfat.

Friesian Class-averages.

The Friesians in the year under review show an increase in average yield over 1921 for each of the seven classes. This increase is most marked in the junior three-year-olds, where the average production has been increased by 78·16 lb. of butterfat. It will also be observed that in the junior four-year-old and mature classes the average production shows increases of 29·84 lb. and 29·34 lb. of butterfat respectively. It will be noticed that the senior four-year-olds are particularly strong, of the eight cows represented four producing over 600 lb., and two of these over 675 lb.—both of the latter being owned and tested by Messrs. H. North and Sons.

The total number of Friesians tested during the year was 168, as against 152 for the previous year. These 168 reached the enviable average yield of 13,498·5 lb. of milk, containing 468·31 lb. of butterfat, in an average lactation period of 345 days. To the end of 1922 a total of 879 certificates has been issued to Friesian cows. The average runs out at 12,829·70 lb. milk and 454·87 lb. butterfat in 341 days, with an average test of 3·55.

The tables of class-averages for 1922 and 1921 are as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1922.		lb.	lb.
Junior two-year-old ..	67	343	11,421·1	404·32
Senior two-year-old ..	15	352	12,382·3	419·29
Junior three-year-old ..	14	358	15,779·2	528·94
Senior three-year-old ..	17	345	14,228·2	480·59
Junior four-year-old ..	9	346	14,361·6	508·51
Senior four-year-old ..	8	346	16,423·1	571·56
Mature	38	341	15,615·3	541·40
	1921.			
Junior two-year-old ..	36	336	10,485·5	382·85
Senior two-year-old ..	24	337	11,419·1	409·03
Junior three-year-old ..	16	333	12,714·3	450·78
Senior three-year-old ..	19	335	12,947·8	469·13
Junior four-year-old ..	8	327	13,566·1	478·67
Senior four-year-old ..	7	362	15,858·7	561·87
Mature	42	341	14,588·7	512·06

Friesian C.O.R. Bulls.

The Friesian certificate-of-record bulls now total fifty-three, and eleven of these gained their place on the list during the past year. These fifty-three bulls have a total of 395 certificated daughters, or over 50 per cent. of the Friesian cows which have qualified to date. The greatest number of daughters added during the year is credited to Woodcrest Joe, who had six names added to his list, making a total of eighteen. This places him second to Cliffside Laddie and King Segis Wild Rose Homestead, who each have nineteen certificate-of-record daughters. Woodcrest Joe is sire of Dominion Pauline, who produced 695·19 lb. butterfat, Dominion Jocrest with 639·48 lb., and many others whose records are of high merit when it is considered they were made

more nearly under ordinary herd conditions than is the case with most cows while under semi-official test. Following is a list of the bulls :—

Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1922.
Cliffside Laddie ..	19	0
King Segis Wild Rose Homestead	19	0
Woodcrest Joe ..	18	6
Sir de Kol Inka Pietertje	16	1
King Fayne Segis 2nd	15	0
Paul Pietertje ..	13	2
Kruger 2nd ..	13	0
Woodcrest Hengerveld Mechthilde	13*	2
Prince Pietje Paxton	12	2
De Kol Pontiac Burke	12	1
Longbeach Van Tromp	11	0
Mutual Piebe of Rock	10	2
Nazli de Kol ..	10	0
Grace's Netherland of Riverside	10	0
Mutual Piebe de Kol	9	0
Netherland King of Rosevale	8	3
Longbeach Primrose League	8	2
Bainfield Dutchman ..	8*	2*
Sir Colantha Korndyke Rag Apple	8	2
Woodcrest Pietje Pontiac	7	2
Oak de Kol 2nd Homestead Fobes	7	0
Edinglassie ..	7	0
Rosevale Korndyke Sylvia Posch	6	2
Mutual Mercedes Pietertje	6	2
Bainfield Prince ..	6	1
King of the Dominos	6	1
Colonel Manor of Riverside	6	0
Woodcrest Johanna Pontiac†	5	5
Royal King Champion†	5	5
Salma Torohunga No. 1†	5	4
Rex de Kol of Sunnycroft	5	1
Colantha Pietertje Count de Kol	5	1
Dominion de Kol Domino	5	0
Colantha Johanna Lad	5	0
Dominion Dutchland†	5	2
Dominion Domino Dutch Boy†	4	2
Longbeach Big Patch†	4	3
King of the Black and Whites†	4	3
Friesland Colantha Lad†	4	1
Medbury Prince† ..	4*	1
Pareora Bindal† ..	4	1
Holland Queen Son† ..	4	1
King Alcartra Rose de Kol	4	0
Colantha Johanna ..	4	0
Indi Paul of Lakeside	4	0
King Segis of Friesland Park	4	0
Pietertje Boy ..	4	0
Longbeach Dutchman	4	0
Netherland King ..	4	0
Rozine's Butter Boy ..	4	0
Longbeach Major ..	4	0
Oakwood Holland King	4	0
Colantha Pontiac ..	4	0

* Also one second-class-certificate daughter. † Qualified during 1922.

MILKING SHORTHORNS AT RUAKURA.

MILKING SHORTHORNS.

Class-leaders.

The certificates gained by members of this breed during the period under review show one change of class-leadership. In the junior three-year-olds Matangi Nancy, owned by Messrs. Ranstead Bros., and with a record of 399·63 lb. butterfat, is replaced by Dominion Carnation of Ruakura, who gained a certificate for 439·20 lb. This increase of approximately 40 lb. brings the record for this class more in conformity with the production of the leaders of the remaining classes. Apart from Maniaroa Princess, leader of the mature class, the leaders for this breed have a fair way to go before the butterfat-production standards set by the other breeds are reached. It is pleasing to note, however, an upward tendency from year to year among the Milking Shorthorns.

The list of class-leaders for 1922 is as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Peach Grove Lady Dinah 2nd	W. J. Slack, Otaki Railway	2 180	258·5	365	9,458·8	430·74
Senior Two-year-old.						
Birkland Dainty ..	G. N. Bell, Palmerston North	2 281	268·6	365	11,616·9	459·98
Junior Three-year-old.						
Dominion Carnation of Ruakura	Ruakura Farm of Intruction, Hamilton East	3 9	277·9	348	9,942·6	439·20
Senior Three-year-old.						
Terrace View Rosy 2nd	T. De la Haye, Ngawapurua	3 360	313·0	365	13,270·8	577·00
Junior Four-year-old.						
Matangi Jewel ..	Ranstead Bros., Matangi	4 6	314·1	365	12,524·4	509·45
Senior Four-year-old.						
Matangi Strawberry 2nd	Ranstead Bros., Matangi	4 351	348·6	365	12,774·6	473·50
Mature.						
Maniaroa Princess ..	Ranstead Bros., Matangi	*	350·0	365	15,951·7	700·76

* Mature.

Milking Shorthorn Class-averages.

As was the case last year, the majority of the classes for this breed are so sparsely represented as to make the class-figures of little value, on account of the influence of individual records. The mature class is again the strongest, but even this class has only eight members, as against twenty-seven the previous year, and the average yield has dropped by some 8 lb. of butterfat.

The best record of the year was made by Mr. D. Buick's Studleigh Nancy Lee. This cow has the very fine credit of 623·37 lb. butterfat from 17,177·5 lb. milk in 365 days. She is a mature cow, and had a previous record of 451·10 lb. in 341 days, also in the mature class.

The class-averages for the breed for 1922 and 1921 are as follows :—

Class.	Number of Cows.	Average Yield for Season. Days in Milk.	Milk.	Fat.
	1922.		lb.	lb.
Junior two-year-old ..	6	358	7,681·4	314·27
Senior two-year-old ..	4	331	8,085·0	312·84
Junior three-year-old ..	4	326	9,238·0	378·51
Senior three-year-old ..	2	333	9,257·2	358·26
Junior four-year-old ..	2	340	9,569·2	368·14
Senior four-year-old ..	1	365	10,963·1	418·04
Mature	8	340	11,200·3	444·28
	1921.			
Junior two-year-old ..	3	365	7,700·7	352·81
Senior two-year-old ..	1	365	7,674·4	329·46
Junior three-year-old ..	3	313	7,836·3	291·72
Senior three-year-old ..	1	327	9,459·0	381·85
Junior four-year-old ..	1	356	10,845·3	392·53
Senior four-year-old ..	1	298	8,695·0	338·51
Mature	27	350	11,342·2	452·84

AYRSHIRES.

The number of Ayrshire cows which received certificates in 1922 was twenty-three, which more than doubles the number for the previous year (eleven). This undoubtedly is a creditable increase, but, unfortunately, it is by no means representative of the number of purebred Ayrshire cows in the Dominion. It is to be hoped that the number of tested Ayrshires will increase annually until the breed takes that place among certificate-of-record dairy stock which its number and quality warrant.

Some very meritorious yields were recorded during the year, eight of the twenty-three certificates issued being on productions of over 500 lb. butterfat, and two of these passing the 550 lb. mark. The best-producing Ayrshire of the year was Fancy of Armadale, owned by Mr. W. Hall, Lepperton. This cow commenced her test at almost eleven years of age—probably past her prime—and in 365 days gave 13,767·9 lb. milk containing 572·18 lb. butterfat. Mr. Fred Mills, the breeder of Alexandra of Waipapa, leader of the four-year-olds, was again prominent, his three entries all gaining certificates on productions of over 500 lb.

The twenty-three Ayrshires certificated during the year averaged 438·09 lb. butterfat from 10,448 lb. milk in 346 days. This should be encouragement for Ayrshire breeders to further their breed by placing more cows or heifers under test.

Ayrshire Class-leaders.

One change is recorded for 1922, in the two-year-old class Bright Smile 4th of Greenbank, owned and tested by Mr. W. Moore, Homebush, superseding Mr. C. E. C. Webb's Greenfield's Sprightly 2nd (507·87 lb.). The new leader commenced her test at an age some ten months younger than her predecessor, and her production of 519·62 lb. butterfat, it will be noticed, raises the previous record by about 12 lb.

Following is the tabulated list :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Bright Smile 4th of Greenbank	W. Moore, Homebush	2 21	242·6	365	13,799·0	519·62
Three-year-old.						
Greenfield's Ina ..	C. E. C. Webb, Koputaroa	3 345	311·5	365	13,958·3	566·02
Four-year-old.						
Alexandra of Waipapa	F. Mills, Waipapa, Hawera	4 348	348·3	365	14,348·6	591·16
Mature.						
Milkmaid of Springview	A. H. Hansen, Te Rehunga	5 349	350·0	365	12,826·2	600·21

Ayrshire Class-averages.

The class-averages for 1922 are as appended. It should be stated that the eleven Ayrshires certificated the previous year were classified according to age in such a manner as to make it impossible to give a table of class-averages.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1922.		lb.	lb.
Two-year-old	4	342	8,981·7	384·71
Three-year-old	6	348	8,679·1	368·27
Four-year-old	2	354	11,266·9	487·55
Mature	11	345	11,797·2	486·58

RED POLLS.

During the year eleven Red Poll cows received certificates. Of these, two gained certificates on second records, one on third, and the remaining eight for the first time. A total of twenty cows of this breed has received certificates to date. Particulars of their yields have been published from time to time, and readers will have noticed that several of these were very meritorious. So far none but the Central Development Farm, Weraroa, has tested animals of this breed. The eleven cows certificated in 1922 are comprised of six two-year-olds, one three-year-old, one four-year-old, and three mature animals. The six two-year-olds averaged 7,509·76 lb. milk and 337·10 lb. butterfat in 348 days, the three-year-old produced 370·48 lb. butterfat in 365 days, the four-year-old 416·01 lb. butterfat in 338 days, and the three mature cows averaged 10,655·0 lb. milk and 455·79 lb. butterfat in 322 days. Taken as a group the eleven animals had an average yield of 8,632·2 lb. milk, containing 379·68 lb. butterfat, produced in an average lactation period of 341 days.

SHORTHORNS.

The first issue of certificates to representatives of this breed, as distinct from Milking Shorthorns, has been made during 1922, five cows gaining first-class certificates and one a second-class certificate, all in the mature class. The average of the five first-class records works out at 422·38 lb. butterfat and 11,222·8 lb. milk in 331 days. The highest record was made by Mr. J. Bateman's cow, Ellesmere Lady Oswald 5th, with 532·58 lb. butterfat and 13,383·3 lb. milk in 365 days.

SECOND-CLASS CERTIFICATES.

It is pleasing to report that the number of second-class certificates issued during 1922 is an exceedingly small proportion of the total number of cows receiving certificates, which signifies that testing breeders are doing all possible to have their cows calve within the fifteen-month limit set by the rules for a first-class certificate of record. The second-class certificates issued during the year 1922 were as follows: Jerseys, fourteen ordinary; Friesians, nine ordinary and one repeat; Shorthorns, one ordinary.

APPRECIATION.

The Dairy Division desires to record once again its thanks for the help afforded by the secretaries of those breeders' associations co-operating in connection with the certificate-of-record testing. The work brings us in close contact with these officers, more particularly with Mr. W. M. Tapp, secretary of the New Zealand Jersey Cattle Breeders' Association, and Mr. M. J. Thomson, secretary of the New Zealand Friesian Association, because of the larger entries received from followers of these breeds. We have always found them untiring in their efforts to lighten our labours whenever called upon, which is many times a year. Not only the Dairy Division but the country as a whole owes much to the men who are endeavouring to improve the standing of the purebred dairy breeds in whose interest they are directing their energies. The Division is also appreciative of the assistance given by various co-operative and proprietary dairy companies in granting its officers facilities for testing milk-samples for butterfat. The Taranaki Producers' Freezing Company, at Moturoa, also kindly granted such facilities.

C.O.R. HEIFERS OF THE WERAROA RED POLL HERD.

PARASITIC WORMS OF LIVE-STOCK.

RECENT ADVANCES IN TREATMENT.

H. A. REID, F.R.C.V.S., D.V.H., F.R.S.E., Officer in Charge, Veterinary Laboratory, Wallaceville.

FOLLOWING the exceptionally wet summer through which we have passed, the prospect of more or less severe infestation of stock by parasitic worms calls for notice of some of the investigations which have recently been undertaken in the direction of effective treatment. Carefully conducted observations and scientific tests tend to show that many of the agents formerly employed as worm-destroyers have little actual value, and that they ought to be supplanted by drugs possessing greater potency. The patient studies of modern investigators have served to demonstrate the efficacy of some of these. Hall, Ransom, Cooper Curtice, Wilson, Wigdor, and Foster in America, and Veglia and Green in South Africa, to mention some of these observers, have each contributed important information on this subject, to which the writer acknowledges his indebtedness.

It is scarcely necessary to remind farmers of the detrimental and at times dangerous results which may follow infestation of the various species of domesticated animals with stomach and intestinal worms. Examples of the disastrous nature of parasitism are within the range of most stock-breeders' experience. Already in the present year some valuable thoroughbred horses have been lost through the fatal effects of round worms, and it is to be feared that during the autumn and winter months further losses embracing other classes of stock may occur. The object, therefore, of this article is to direct attention to the beneficial effects of certain drugs which, when judiciously employed, may be relied upon to achieve definite results. For the sake of clarity it is proposed to take in order the species of domesticated animals chiefly concerned, to mention some of the more important worm-infestations from which they may suffer, and to suggest the most suitable antidote.

HORSES.

Parasites of the Stomach.

The parasites in this situation with which New Zealand farmers are most familiar are the "bots." These represent the larval stage of the Oestridae or bot-flies belonging to the genus *Gastrophilus*. Of the eight species described, at least three are known to occur in New Zealand—*Gastrophilus equi*, *G. haemorrhoidalis*, and *G. nasalis*.

The question as to the seriousness or otherwise of infestation by these parasites is largely a matter of opinion. Some authorities affirm that bad or even fatal results may follow, while others are inclined to view the presence of bots with far less apprehension. The parasites live upon the tissue-juices, which they absorb from their host, and the lesions set up consist of a slight diffuse gastritis and localized ulceration over the area of the stomach, or, in the case of *Gastrophilus nasalis*, first part of the bowel (duodenum) occupied by the bots. Their sojourn

in these situations is purely temporary, for in the spring and early months of summer the larvæ become detached and are passed out with the dung, to undergo on the ground further development into flies. Should the horse be aged or suffer from broken or irregular teeth, or if feed be scarce, it is conceivable that the presence of bots may add to these disabilities and assist in promoting some degree of malnutrition. But in the writer's experience mortality traceable solely to this cause has not been met with. The obvious presence of the bots during post-mortem examinations has frequently led to conjecture on the part of laymen that the parasites are accountable for the death of the subject, whereas other more serious lesions which ultimately caused the mortality have been overlooked, either through failure to recognize them or through want of diligence on the part of the investigators.

The consideration that, practically speaking, no horse kept in country districts is altogether free from infestation—sometimes to a severe extent, as witnessed when holding post-mortem examinations on subjects dead from other causes—goes far to exonerate the bot from the charges made from time to time against this parasite, and to which medicine-vendors naturally lend support.

Treatment.—Horse-owners who may decide in favour of expelling these invaders of the equine stomach are recommended to employ carbon bisulphide in doses of 4 or 5 drams given in a capsule. Subjects should be fasted for twenty-four hours beforehand, and not allowed food or water for four hours after treatment. To aid in expelling the parasites a pint of linseed-oil may be given not less than two hours after dosage. If given earlier the oil retards the action of the drug. Larvæ of the *Gastrophilus equi* are effectively removed by this process. Those of *G. nasalis*, owing to their situation in the hinder part of the stomach and first portion of the small intestine, are somewhat less susceptible. Larvæ of *G. haemorrhoidalis* which have migrated to the large bowel will escape the action of the carbon bisulphide, though the oil purge will help to clear the bowel of their presence.

Parasites infesting the Bowels.

Of these parasites by far the most serious are the infestations due to round worms (or "wire-worms" as they are often called), known technically as strongyles or sclerostomes.

The two principal species are termed *Sclerostomum equinum* and *Sclerostomum tetracanthum*. *Sclerostomum equinum*, sometimes called the "armed strongyle" on account of the presence of "teeth" in the mouth parts, is a formidable parasite, not solely on account of any particular damage produced in the cæcum (or "blind gut") and large intestine, where it is found often in company with the latter species, but from the fact that immature forms of this worm inhabit the blood-vessels, where they cause tumour-like enlargements, known as aneurisms. Fatal cases of colic, due to impediment of the circulation and rupture of the vessels involved in these complications, are a not infrequent source of mortality among horses infested by this parasite. *Sclerostomum tetracanthum* is less dangerous. Worms of this species encyst themselves in the mucous membrane of the bowel, but their embryos do not invade the circulation or create the grave lesions characteristic of the former species.

Infestation by wire-worms, apart from the secondary lesions, which may provoke a fatal termination, often sets up a severe form of anæmia and diarrhœa, which undermines the animal's constitution and sometimes ends in death.

Treatment.—To destroy and expel from the intestines the mature worms, American wormseed-oil (oil of chenopodium) is recommended by Hall, after carefully planned experiments to ascertain its reliability and superiority over drugs formerly used for this purpose. The plant from the leaves and seeds of which the oil is extracted is largely cultivated in Maryland, U.S.A. The variety used is known as *Chenopodium ambrosiodes* var. *anthelminticum*. On account of its objectionable taste and smell, and of the burning sensation it produces, it is best given in gelatine capsules; or it may be mixed with oil, care being taken to shake the bottle repeatedly during the dosage to prevent the oil of chenopodium from rising to the surface. The animals to be treated are fasted for thirty-six hours, and 4 to 6 drams of the oil of chenopodium are then given either in a capsule or in linseed-oil. In the former case it should be followed immediately by 1 to 2 pints of linseed-oil, or a physic-ball. Should one treatment fail, which may happen if the purging is not effective, an interval of eight days must elapse before the chenopodium is repeated.

In the case of *Sclerostomum equinum* the dosage will only affect the worms present in the bowel. The embryos entrenched in the walls of the blood-vessels will, of course, not be reached by the drug. Regular dosing and prevention of reinfection will, however, tend to reduce the danger arising from the presence of these immature forms.

To prevent reinfection among grass-fed animals is not always an easy task. Horses after they have been dosed should be removed from paddocks known to be infested. These should then be utilized for stock, such as cattle and sheep, which are unsuitable hosts for the sclerostomes, or the paddocks may be placed under cultivation.

CATTLE.

Stomach-worms.

Stomach - worms are sometimes accountable for serious outbreaks of disease among calves and young stock, characterized by profuse diarrhœa, wasting, and anæmia. These symptoms follow upon a diffused inflammation of the fourth stomach (abomasum), created by the presence of large numbers of the worms.

The worms responsible for setting up these changes are known as strongyles. They are round worms, and include, as a rule, one or more of the following species: *Haemonchus contortus*, *Strongylus convolutus*, *S. fillicollis*, *S. gracilis*, and *Tricocephalus affinis*. To the farmer the differentiation of species is a matter of little practical importance, since any of the worms just named may be implicated in causing the condition known as parasitic gastro-enteritis, an acute inflammation of the stomach and small intestines leading at times to heavy mortality.

Treatment will be referred to when considering these parasites in relation to the infestation of sheep.

SHEEP.

"*Grub in the Head.*"

Judging by the number of inquiries which come to hand this trouble appears to be of fairly common occurrence among sheep in New Zealand. The so-called grub represents the larval form of the sheep-fly, *Oestrus ovis*. The fly is a small species of a greyish-yellow hue. It attends sheep while these are grazing during the warmer months of the year. The female fly deposits its eggs about the sheep's nose, whence they reach the nasal cavities and undergo transformation into larvæ. The larvæ often penetrate into the air-sinuses of the head, or, passing through the perforations in the upper part of the nasal bone, may reach the brain. After spending about ten months in these situations the larva attains maturity, and by its own movements gains access to the nostrils. The irritation set up causes the sheep to sneeze violently, by which act the larva is expelled on to the ground, where it undergoes further development into the mature fly. It is when butchering sheep and splitting open the head that these larvæ or "grubs" are sometimes discovered.

In this country, so far as can be ascertained, little trouble is attributed to the attacks of the fly, but in Europe sheep are stated to suffer severely from the effects of this pest. The symptoms, apart from the annoyance and distress caused through the female fly seeking to deposit her eggs, consist of convulsions, vertigo, circular movements, discharge from the nostrils, and occasionally difficulty in breathing. The writer has been unable to observe severe manifestations of this nature. In this country, at any rate, examples would appear to be rare.

In countries where the presence of the fly assumes menacing proportions endeavours to prevent attacks are made by smearing the sheep's nostrils with pine-tar or other fly deterrent, and by avoiding grazing in summertime in proximity to trees and scrub which may harbour the fly. Shepherds are also in the habit of administering snuff or similar irritant powders to induce fits of sneezing and aid in expelling the grubs. Measures of this nature would only be practicable among small flocks such as are owned by the peasant farmers of European countries. On a larger scale such efforts at protection, which at best are only of very limited value, would rightly be regarded as impracticable, nor under existing conditions in this country do they appear to be necessary.

Flukes.

These leaf-shaped worms, which are sometimes present in the livers of sheep and less frequently in cattle, occur in certain parts of New Zealand, though they are not a common cause of serious trouble. In Europe and elsewhere infestation with these parasites produces the disease known as "liver-rot," which in certain seasons is accountable for very heavy losses.

The liver-fluke needs for one stage of its development a suitable species of fresh-water snail. The trouble is therefore dependent upon the existence of this particular intermediate host. Pastures on low-lying, badly drained land, or where sluggish watercourses or ponds exist, offer conditions suitable for the snail and the propagation of the fluke.

Preventive Measures and Treatment.—Preventive measures are of first importance. These consist of draining, liming, and salting the pastures to render them unfavourable for the snails. With this object also in view watercourses and ponds may be subjected to the action of sulphate of copper. It is stated that sulphate of copper in solution of one part to 1,000,000 parts of water, or 1 oz. to 7,800 gallons, will prove effectual in this respect.

French authorities advise dosing infested sheep with ethereal extract of male fern. One tablespoonful of the male fern is given in a tablespoonful of olive-oil on five consecutive days. The practical difficulties attending this line of treatment when attempted on a large scale are apparent. In the earlier stages of the disease, which are difficult to detect, medicinal treatment might prove effectual, but when once marked symptoms such as wasting, dropsy, and anæmia appear it is doubtful whether internal medication could possibly save subjects suffering from extensive fluke invasion.

Stomach-worms.

The complaint known as parasitic gastro-enteritis is apt to cause heavy losses among lambs and sheep, particularly during the late autumn and winter months. Sheep become infested through consuming herbage or water contaminated by the droppings of sheep or cattle harbouring the worms responsible for setting up this condition. These worms correspond with the species mentioned in relation to the stomach-worms of cattle, with, in addition, a species known as *Strongylus cervicornis*. These latter are so small as to easily escape casual observation. They may, however, be demonstrated in freshly slaughtered animals by examining a little of the contents of the abomasum and a scraping of the mucous lining spread on a piece of glass, for preference with the aid of a hand-lens against a dark background. The round worm (*Haemonchus contortus*) frequently predominates, though several different species can usually be recovered from typical cases of the complaint.

Treatment.—A successful form of treatment devised by Cooper Curtice, of the Zoological Division, United States Bureau of Animal Industry, consists of drenching lambs and ewes at regular intervals with a mixture of bluestone (sulphate of copper). The following directions extracted from the *Journal of the American Veterinary Medical Association* are descriptive of the method employed :—

The stock solution : A stock solution is prepared as follows : Coarsely powdered bluestone, 1 lb. ; boiling water, 2 quarts. Add the bluestone to the water and dissolve it completely. Replace any water that evaporates to make a total of 2 quarts. Store in glass or stoneware, tightly stoppered. This will keep indefinitely, and when diluted for use is sufficient for 400 doses. *This is a stock solution and must not be administered in this strength, for it will kill sheep.* It must not be allowed to lose water by evaporation.

Dilution for use : For use 3 quarts of water are added to 4 fluid ounces of the stock solution for each twenty-five head of sheep to be dosed.

Apparatus : The apparatus needed consists of one 4 oz. glass graduate, one graniteware quart measure, one graniteware gallon measure, and one drenching-tube. A baby's graduated nursing-bottle may be used instead of the graduate and tube, but it is not so convenient, and it takes more time. The drenching-tube consists of three pieces fitted together in this order : A hard or flexible rubber or graniteware funnel, a 3½ ft. rubber tube, and a 6 in. brass tube. The calibre of the rubber tube is ⅜ in. ; the brass tube and the funnel fit into it. The outside diameter of the rubber tube is ⅝ in. A thinner tube has proved less convenient to handle and less durable.

The dose: The bluestone is used only after dilution by the addition of water to the stock solution. Four fluid ounces of the diluted solution are given to each sheep weighing 80 lb. or over. The weight of the sheep may be estimated, but the doses are measured accurately, not guessed at. For a lamb of 60 lb. a dose of 3 fluid ounces and for a lamb of 70 lb. 3½ fluid ounces is used. It has been found unnecessary to take the sheep from the pasture until a short time before dosing. A convenient small pen is prepared either within or next to a large one, so arranged that a few sheep may be driven in quickly and individual sheep released outside after dosing.

Dosing the sheep: Two persons are necessary to give the dose. One straddles the sheep, holds its muzzle with one hand, and inserts the tube 4 in. into its mouth with the other. The other person measures the dose, holds the drenching-tube, and pours the dose into the funnel. Backing the sheep into a corner helps to steady it. The sheep should remain standing with its head nearly horizontal, and care should be taken not to choke or strangle it. Plenty of time should be allowed for it to swallow. Moving the tube in the mouth often aids in getting the sheep to swallow. More than fifty sheep may be dosed in an hour by experienced operators, but *carelessness and haste are dangerous and must be avoided.* The dosing should preferably be done under competent veterinary supervision. In any case it should not be entrusted to inexperienced or naturally careless persons.

Time of dosing: All sheep on the farm except young lambs are dosed regularly every four weeks throughout the year, but pregnant ewes are not dosed within two weeks of lambing. The dosing of the ewes is renewed at the next regular dosing date after lambing. If for any reason it has been necessary to change the date of dosing, a slightly earlier day has been chosen rather than a late one. Sheep occasionally have been dosed one week after a previous dosing without apparent harm. Under such circumstances the next dose follows in four weeks. During the growing-pasture season three-week intervals between doses are better than four-week intervals. The regular dosing of lambs is begun as soon as they are weaned.

Within the last two years the writer has had experience of a very severe outbreak of parasitic gastro-enteritis affecting a flock of ewes, which led to the death of a fair proportion of the animals attacked. The worm chiefly responsible proved to be *Haemonchus contortus.* More recently a similar outbreak affecting goats came under observation. Both these outbreaks were dealt with medicinally by the method adopted by Veglia and Green in South Africa, and referred to in the reports of the Director of Veterinary Research, Union of South Africa, 1919. This method combines the copper-sulphate treatment of Cooper Curtice, with the addition of arsenite of soda. The chemical combination of these two drugs is soluble only in an acid medium—a condition met with in the abomasum, the seat of the worm infestation, but not in the other three compartments of the stomach. The average dose for fully grown sheep is 2 grains of the arsenite of soda with 10 grains of copper sulphate, given as an electuary made up with treacle. Lambs and hoggets should receive proportionally smaller doses.

In practice a quantity of the solution is prepared sufficient for, say, one hundred sheep, as follows: Arsenite of soda, ½ oz.; sulphate of copper, 1½ oz.; hydrochloric acid, ½ oz.; water, 1 quart; violet dye sufficient to colour the solution. The dye is added to give character to the poisonous solution and to prevent its accidental use for other purposes. By staining the mouth parts of the sheep it also enables dosed to be distinguished from undosed animals.

Average doses of the mixture are as follows: Lambs two to four months, 45 minims; lambs four to six months, 1 dram; lambs six to ten months, 1½ drams; two-tooth sheep, 2 drams; full-grown sheep, 2½ drams. The dose should be given for three consecutive mornings, and repeated three times at intervals of a fortnight, and then three times at one-month intervals.

Precautions to be observed: The dosage should be carried out, if practicable, after eighteen hours' starvation, and the first feed should be given four or five hours after the dose. When the arsenical mixture is used, salt in any form, such as salt licks, should be withheld, and water should not be allowed for some hours after the dosage. A graduated syringe is recommended for administering the dose, which should be slowly injected into the mouth while the animal is in the standing position. An assistant to hold the sheep is necessary. Great care should be exercised to avoid the dose "going the wrong way." Should a fit of coughing occur, the head must be at once released, as if any of the mixture should reach the lungs the results may be rapidly fatal.

We have found this system of treatment highly successful, and prefer it to the copper-sulphate-alone method.

Preventive Measures.—These include, if possible, complete change of pasture. The sheep must be removed from the contaminated area, which must remain empty or be used for grazing horses for not less than a year. Infested pastures may, as an alternative, be ploughed and cultivated, and the crops fed off by sheep. Drainage, liming, and salting are also indicated as means to be resorted to in combating the persistence of ova and embryos of the worms. The sheep should be dosed before being placed on fresh pasture-land, otherwise this in turn will soon become heavily contaminated. If possible, extra feed, particularly in winter-time, in the shape of a daily ration of crushed oats, chaff, and crushed linseed cake, should be fed from troughs. An allowance of hay fed from racks is also advisable.

Although we have not yet had the opportunity of trying either of the above methods of treatment on cattle affected with parasitic gastro-enteritis, it is reasonable to suppose that they would be equally effective, the doses in the case of calves of six months and upwards being increased to double the amount recommended for sheep. The general measures regarding precautions to be observed and prevention of reinfection would, of course, apply in the case of either species of ruminant.

SWINE.

Pigs often suffer severely from the presence of round worms in the bowel, causing scouring and loss of condition. Young pigs, which are more susceptible to the ravages of parasitic worms, receive a severe set-back and sometimes remain stunted and unthrifty-looking on account of the damage sustained by the digestive organs in earlier life through worm infestation.

Prevention and Treatment.—Pigs are exceedingly awkward animals to handle, and regular dosing with medicine involves so much time and trouble that few farmers can be expected to follow up this line of treatment. Prevention of infection therefore becomes all the more important. A system advocated by Ransom and Raffensperger in America recommends that before farrowing sows should be carefully washed to remove dirt and any adherent worm-eggs, and then placed in a thoroughly clean farrowing-pen. Two weeks after farrowing the sow and pigs are pastured on clean ground which has been cultivated and sown in fodder crops. There they are kept for a period of about four months. This system ensures relative freedom from worm infection during the most

susceptible period of the pig's existence. Cleanliness of the sties and runs should receive constant attention, in order to avoid the ground becoming fouled with excrement which may contain the worms or swarm with their ova.

As regards medicinal remedies, the results obtained by dosing with oil of chenopodium are said to be very satisfactory. About 2 drams of the oil should be given, after fasting twenty-four hours, in 2 oz. to 4 oz. of castor-oil, in which it must be well shaken up. The mixture can be conveniently prepared for use by adding to the oils a few drops of liquor potassæ, a teaspoonful of sweet spirit of nitre, and a ¼ pint of water. This mixture when well shaken up forms a creamy emulsion which is easily poured from a bottle or tin drenching-can. During medicinal treatment the pigs should be kept in a sty, and not allowed to roam on clean pastures. After the medicine has acted, the sty should be thoroughly cleaned out with the aid of boiling water and washing-soda.

LUCERNE-GROWING IN VINCENT COUNTY (CENTRAL OTAGO).

W. D. REID, Biological Laboratory, Wellington.

THE following notes relate solely to lucerne grown in Vincent County (Central Otago), an extensive area comprising many types of soils and a number of farming systems, and conspicuous by possessing the lowest rainfall of any part of New Zealand. Of the total of approximately 2,000 acres of lucerne examined—which represents nearly the entire acreage under that crop in the county*—it is interesting to note the average areas grown by the respective types of farming in relation to the acreage of the holdings. Thus orchards have 1 acre of lucerne to 18 acres of holding; general farms of under 1,000 acres have 1 acre to 15 acres of holding; small grazing-runs of 1,000 to 20,000 acres grow 1 acre to 250 acres; and the pastoral runs over 20,000 acres grow 1 acre to 10,000. From this it can be seen that up to the present it is only on the farms of under 1,000 acres that the real value of lucerne is adequately recognized, although the crop is admirably adapted to all classes of holdings in the county.

Lucerne has been established in this district for more than twenty-five years, but it is only within the last seven or eight years that the bulk has been laid down, and, except on orchard holdings, the areas of this important crop must increase enormously with the extension of irrigation, bringing, as it will, dairying and closer settlement to many parts of the county. Lucerne has been easily and successfully established on all classes of soils in the district, but is as yet restricted to isolated portions of the river-valleys, terraces, and the mountain foothills. There are many thousands of acres where excellent lucerne stands could be cheaply established, and the yields even from non-irrigated fields are so satisfactory that a real extension of lucerne-growing in Vincent County could easily double the number of stock carried.

* As estimated by Mr. R. B. Tennent, Instructor in Agriculture, Dunedin.

ESTABLISHMENT.

In most cases the lucerne-paddocks are ploughed just previous to sowing, from virgin ground which in its natural condition carries about one-third of a sheep to the acre and is but scantily covered with storksbill (*Erodium cicutarium*), annual fescue (*Festuca myurus*), and poa tussock (*Poa caespitosa*). Where irrigated grass and fescue-tussock (*Festuca novae-zelandiae*) paddocks have been utilized, the ground is broken in the spring and worked up rapidly if for immediate sowing, or fallowed if sowing is held over till the autumn or spring of the following year. On the non-irrigated virgin ground a seed-bed is readily produced, after ploughing, with one stroke of the disk harrow, one with the spring-tooth cultivator, and one with the tine harrow, while sometimes even less cultivation than this is given. Very occasionally paddocks have been roughly graded to assist in the later irrigation or haying, but on the whole it is not the practice to select or work areas to facilitate later management of the crops. From the foregoing it can be seen that successful results follow even where very little labour is expended in producing a seed-bed.

Of the crops 85 per cent. have been spring-sown (September and October), the spring sowings being earlier than in any other part of New Zealand, and the remainder in March. Although the early growth is sometimes retarded by weeds or autumn frosts, recovery is general, and no noticeable difference exists between the established crops of the respective sowings.

Some 59 per cent. of the crops have been pure seedings; 24 per cent. have been sown with oats; and 17 per cent. sown with grass mixtures, red clover, or wheat. When the lucerne is sown with oats (2 bushels per acre) the growth is retarded in the first season, but this method of establishing two crops from the one working and sowing apparently does not affect the final stand of lucerne. This only indicates that in Vincent County, at any rate, lucerne is the easiest of any permanent crop to establish successfully. Where red clover is sown in conjunction with lucerne 2 lb. to 4 lb. of clover-seed is used, and the clover dies out in two to three years. It gives an early and luxuriant growth, but this does not injure the subsequent development of the lucerne. Where sown down with grass (say, 7 lb. lucerne, 8 lb. cocksfoot, 10 lb. rye-grass, and 2 lb. white clover per acre) the aim is to produce a permanent sward with lucerne as the dominant clover, to be used either solely for grazing purposes or for occasional hay-production followed by winter grazing.

Practically the whole of the lucerne crops are broadcasted, with an average seeding of 14 lb. per acre, either by hand or with a hand machine, and tine-harrowed in, as in this dry district comparatively deep burying of the seed is not harmful. The rate of sowing has ranged between 5 lb. and 23 lb. per acre, and even with the lower amount satisfactory stands have resulted. There is a general opinion, however, that from 10 lb. to 14 lb. represents the most suitable quantity to use. Marlborough and Hunter River are the usual varieties sown, and although others have been tried they have not justified their use even for special conditions.

Manuring is not practised, and applications of lime and inoculated soil are uncommon. Where such methods have been adopted the stands of lucerne do not show any improvement over the non-treated

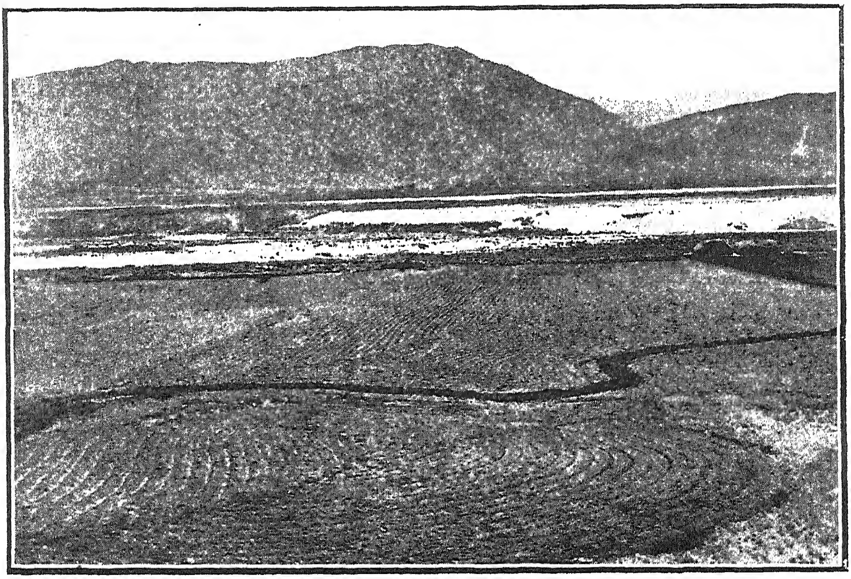


FIG. 1. PORTION OF A 50-ACRE LUCERNE-FIELD AT BANNOCKBURN (HOLLOWAY BROS.).

Crop mown, with haymaking operations in progress. Kawarau River in middle distance.

FIG. 2. LUCERNE AND GRASS MIXTURE (A. CROMBIE, BANNOCKBURN).

Sowing five years old when photographed.

[*Photos by W. D. Reid.*

areas, and in most non-inoculated crops nodule development is abundant. It would appear as if lime or inoculated soil would only be necessary in exceptional circumstances, and none of the crops at present growing on the various types of soil indicate these requirements.

Throughout the district good strikes are general under all systems of sowing, and even where poor germination or growth has occurred in the first season later irrigation or rainfall has generally improved the stand. A few farmers have failed to establish the crop even where the strike was excellent, but in all these cases the young crops have been mismanaged by spring stocking, continual stocking, or sowing with a feeding-off crop such as rape.

THE FIRST SEASON OF GROWTH.

As regards the first season of growth, no universal system of treatment exists, but the procedure here described more or less holds good, particularly in regard to the spring sowings. The autumn sowings possibly receive an irrigation after establishment, but otherwise they are not worked until the following spring, when the treatment is similar to that of established crops.

In the case of spring sowings where water is available the crop is irrigated when it has attained a height of 5 in. to 6 in., in November or December, and with pure sowings the applications of water are repeated every four to six weeks of the growing-period, such applications usually coinciding with those made on the established areas. With combined oat-sowings the second irrigation is given before the cutting of the oats—in January or February—for chaffing. Approximately one-third of the stands have not been irrigated during the first season, comprising the crops of the non-irrigated areas and those for which water has not been available in the first season of growth. It is the practice, however, to irrigate during the first season when water is available.

Of the pure sowings about 50 per cent. have been cut when 5 in. to 6 in. in height and the growth left on the ground, the idea being that it acts as a mulch, and in the dry climate of Vincent County this method is probably advantageous. If the young growth contains a large amount of weeds, or if vigorous weeds such as Californian thistle or fat-hen be present, several cuts are made during the first season and left to wither on the ground. Where the first cut is sufficient to retard the weeds, subsequent growth is occasionally removed as a small cut of hay, but more often the stand is summer-grazed during its first season. It must be remembered that what is now being stated is not advice as to how the crop should be treated, but is merely an account of what is done. The writer is well aware that in many districts grazing in the first season to anything like the extent practised successfully in Central Otago would be harmful. About 25 per cent. of the stands have not been cut at all in the first season, but have been autumn-grazed, and in approximately another quarter of the stands where the weed-content has not been high the crops have been cut for hay in February and the later growth grazed.

In the oat-sowings the growth of lucerne arising after the harvesting of the oats is occasionally cut for hay, but autumn grazing is more usual. The early treatment of the lucerne and grass mixtures is similar to the foregoing in that they receive periodic irrigations, and when weeds become aggressive are run over with the mower; they are also autumn-grazed during the first season.

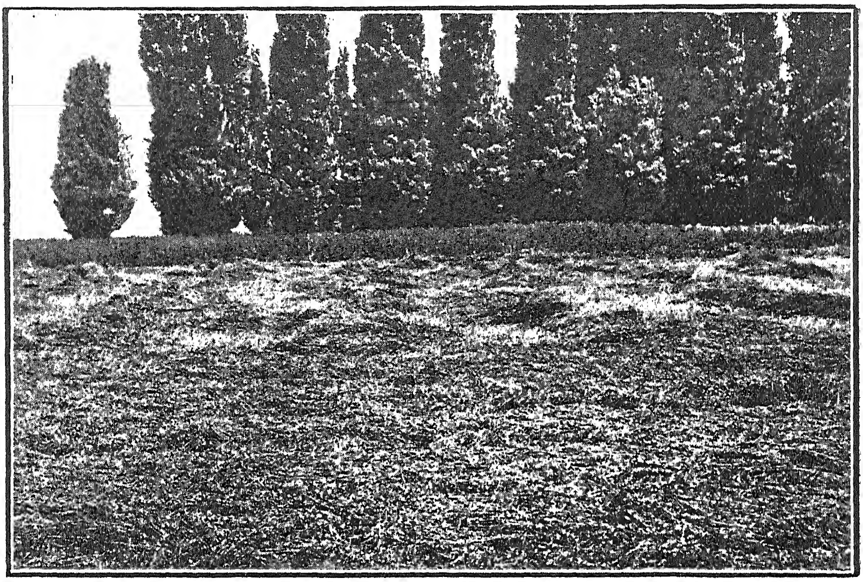


FIG. 3. LUCERNE AND CALIFORNIAN THISTLE.

In foreground, established lucerne cut for hay. In background, thistle area in which lucerne is establishing.

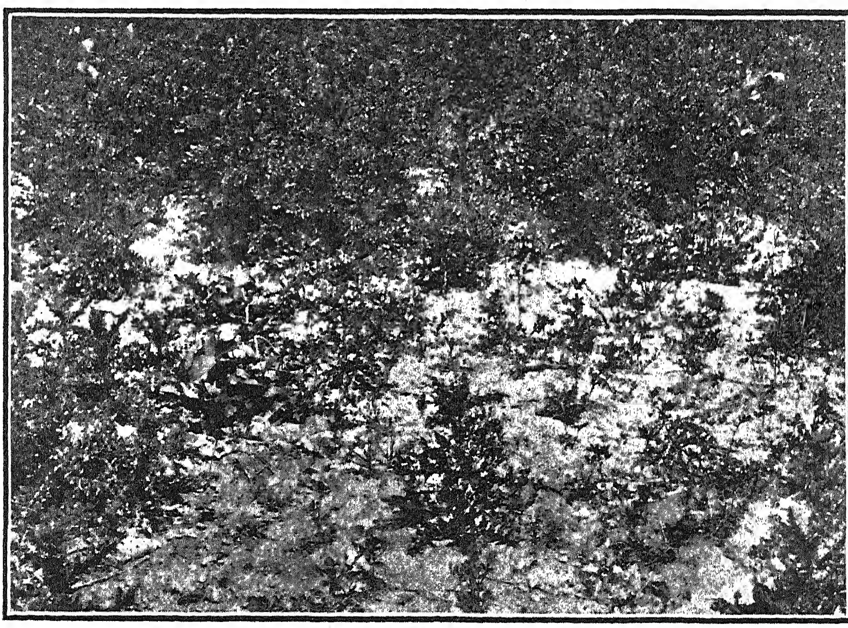


FIG. 4. SMALL LUCERNE-PLANTS IN CALIFORNIAN THISTLE AREA SHOWN IN FIG. 3.

[*Photos by W. D. Reid.*

METHODS OF IRRIGATION.

Although a large number (approximately 25 per cent.) of the lucerne stands are at present being maintained without irrigation and are yielding quite excellent crops, the application of water is a great factor in securing heavy yields. The bulk of the irrigation water is obtained from small privately owned races of local origin, but the large irrigation systems of the Public Works Department and private companies will be the main future sources of water necessary for extension of the more intensive farming systems.

The methods of application of water to the crops are simple, though with the small amount of water available at one time more or less constant attention is required to obtain even distribution. So far little is known as to the amount of water required or received by the crops, and as the soil conditions, slope of the fields, and the water-supply are extremely variable no two crops are treated alike. In one or two cases the fields have been graded to facilitate irrigation and working, but although different slopes of country require different irrigation systems the general method is to distribute by gravitation races and finally by plough-furrows. The farmers prefer a large quantity of water to rapidly flush the paddocks, but it is doubtful whether this method is more efficient except on graded slopes and gravel or sand formations, where natural drainage is possible. On the comparatively level paddocks of silt formation, particularly those with slight hollows, over-irrigation frequently takes place. When it is considered that water equal to 140 in. of rainfall is often applied in a growing season it is obvious that good drainage of at least the upper soil is essential for the health of the lucerne. On an average, however, where a large quantity of water is available, about 60 in. is supplied, and it is clear that this is far more than sufficient for maximum-crop production, particularly on the clayey loams.

Lucerne-fields up to 20 acres in extent receive two irrigations for each cut of hay, but on the larger areas of 40 acres to 60 acres a long time is taken to flood the whole crop, so that on the large fields it is more practicable to apply only one irrigation for each hay-cut. For example, one farmer requires nine days to irrigate 50 acres with 3 heads (cusecs) of water. On a few small paddocks as many as three to four irrigations are given for each cut, and on others where the water-supply is limited the crops receive only one or two irrigations in the season. It will thus be seen that there is no regular or uniform system in applying water.

MANAGEMENT.

Lucerne-fields are closed for the first hay crop in late August or early September. The first cut is taken off at the end of November, and averages about 1¾ tons of hay per acre. This spring growth is comparatively slow, and contains a large proportion of weeds, such as rye-grass, mouse-eared chickweed, rib-grass, and Poa pratensis, which, however, generally give no further trouble in the succeeding cuttings. On the small areas it is not uncommon to secure three further cuts during the season; but more often two further cuts are taken on irrigated stands—one during the middle of January averaging about 1½ tons of hay, and the other at the beginning of March averaging about 1¼ tons. A fair amount of growth takes place in March and early April,

when the fields are heavily stocked until they become somewhat closely eaten down, at which time most of the stock is removed, but a certain amount of continuous grazing is carried out until the fields are again closed for hay. Although the winter months are a period of non-growth of lucerne, the stands are utilized for the weed and grass growth they produce.

Where hay feeding is carried out during the winter on the lucerne-fields the stocking may remain heavy during the whole period, but, in general, hay feeding is carried out on grass-paddocks, and the lucerne-fields are not utilized for this purpose. Owing to the light rainfall of the district (14 in. to 18 in. yearly) the haying process is comparatively short and certain, generally occupying four days—cutting on the first day, raking into windrows on the second, cocking on the third, and

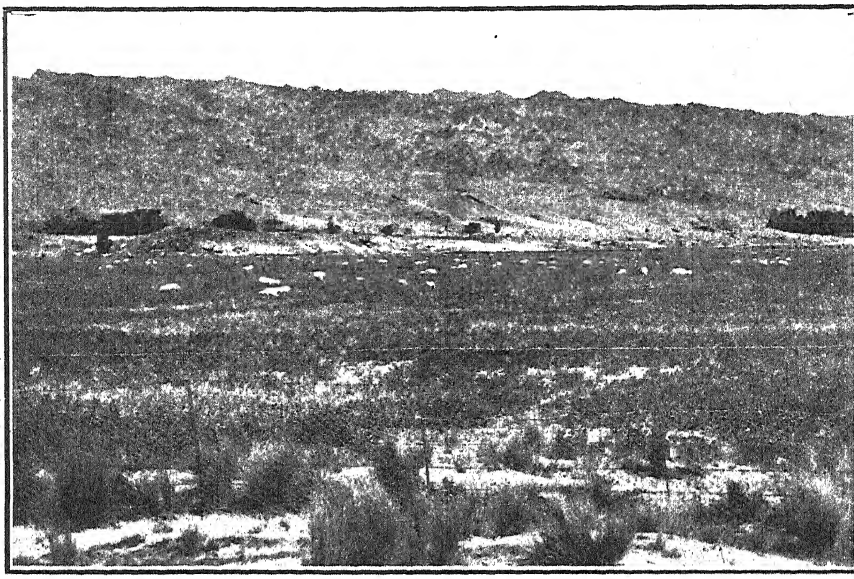


FIG. 5. SUMMER GRAZING OF A LUCERNE-FIELD AT NORTHBURN STATION (D. MIDDLETON).

This field is irrigated occasionally. Poa tussock in foreground.

[*Photo by W. D. Reid.*

stacking on the fourth. On the large areas the process is a three-day one, by replacing the two days of raking and cocking by one day in the swath.

From the estimates given about 4½ tons of hay would appear to be the average annual yield of irrigated lucerne in Vincent County, but, of course, there is a good deal of variation, depending on the condition of the stand and the elevation. Some average clean irrigated stands, the hay from which has been baled and weighed, give a fairly exact idea of the return as follows: 200 tons hay from 50 acres (three cuts), 42 tons from 10 acres (three cuts), 33 tons from 6 acres (three cuts). To these yields must be added the autumn growth, which is possibly equal to half the final hay-cut.

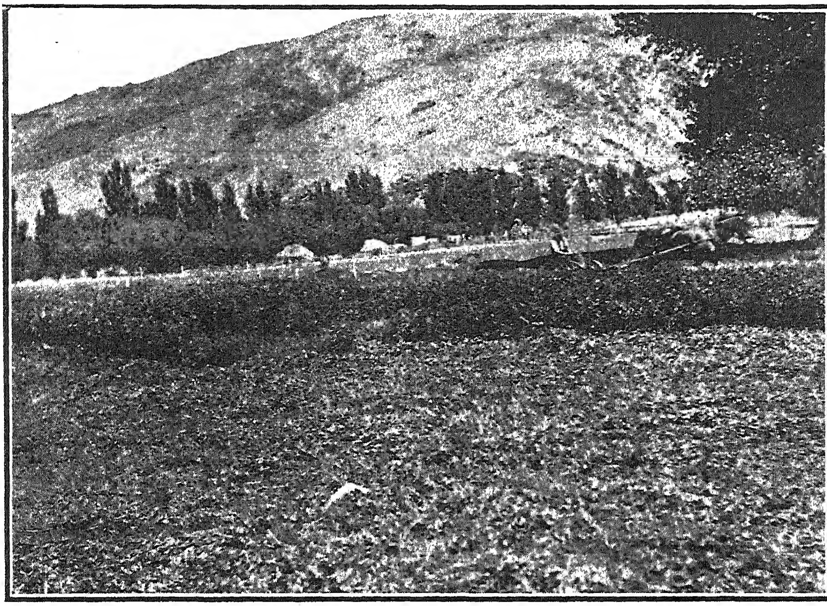


FIG. 6. AN AVERAGE FIRST CUT OF LUCERNE, BUT SHOWING EFFECT OF OVER-IRRIGATION IN HOLLOW.

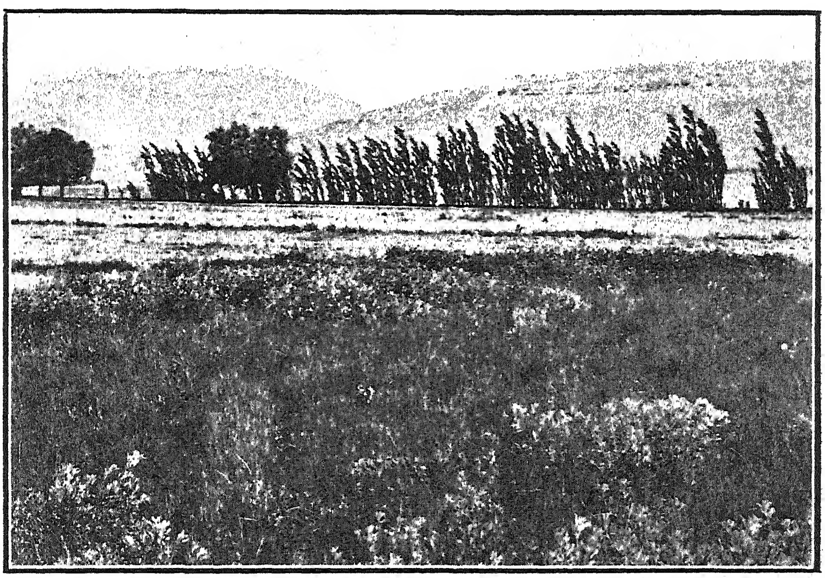


FIG. 7. OVER-IRRIGATED LUCERNE, WITH REPLACEMENT (IN FOREGROUND) BY POA PRATENSIS AND RYE-GRASS.

[*Photos by W. D. Reid.*

The hay obtained is the main winter feed on the farms, and although in one or two cases it is sold for local consumption the quantity available is rarely sufficient for the adequate feeding of the stock on the holdings, particularly on the larger runs. One of the most valuable uses of lucerne hay in Vincent County should be for the feeding of ewes during winter, and were sufficient lucerne grown for this purpose many of the holdings could turn off large numbers of fat lambs. Only on a few of the holdings are large flocks of sheep systematically fed with lucerne hay during the winter, but where this practice has been adopted it has given excellent results. In one instance the hay from an area of 50 acres supports approximately 2,500 ewes in lamb for a little over two months, representing a consumption of about 3 lb. of lucerne hay per day during that period when feed is scarcest. In this particular instance 50 acres of lucerne support the sheep for two months of the year, while 11,000 acres are used to support them for the remaining ten months. Can there be any more striking example of the value of lucerne in increasing the meat and wool production of the country?

Most of the crops are used solely for hay-production, but many growers, including those who sow a lucerne and grass mixture, either use the fields for grazing alone or for a spring hay-cut followed by either continuous or periodical grazing. The latter system of treatment—one hay crop followed by grazing—is the common manner of dealing with the non-irrigated areas of lucerne, which, though not so productive as the irrigated crops, could be grown much more extensively and with profitable results on the low river-banks and much of the lower slopes of mountain-ranges. The lucerne-grass paddocks suit admirably for both grazing and hay purposes, but if continuously grazed the lucerne is gradually killed out and the paddocks require renewing every eight or nine years. On the other hand, when spring growth is not stocked up to the time of the first hay-cut—and this applies to all lucerne areas in Vincent County—the lucerne remains permanent and dominant. As these grazed lucerne-paddocks are used in conjunction with grass pastures, no reliable figures of carrying-capacity are obtainable.

For the most part the lucerne stands are not cultivated, and are comparatively free from weeds, but the more common growths in the irrigated crops are Poa pratensis, rye-grass, white clover, red clover, mouse-eared chickweed, cocksfoot, dock, rib-grass ; and in the non-irrigated areas storksbill, chickweed, goose-grass, barley-grass, sterile brome, and rye-grass. These are found in all crops in varying amounts, but only where either grazing methods or over-irrigation have been practised are they at all dominant. Where the weed plants have become aggressive a few growers have resorted to winter and "between cuts" cultivations with spring-tooth cultivators and toothed disk harrows, and under the ordinary conditions of haying, moderate irrigation, and reasonable stocking, successful results have been obtained. On the other hand, fields which have been spring-stocked instead of being hayed, or over-irrigated, do not respond to cultivation, but are apt to become badly infested with Poa pratensis.

CONDITIONS LEADING TO DETERIORATION

The conditions which lead to deterioration of the stands can be briefly summarized as follows :—

Spring stocking or continuous stocking: Areas, both irrigated and non-irrigated, which have been kept stocked during the period of the spring growth rapidly deteriorate; weeds become dominant, and thorough working of the ground and renewal of the stand by seeding finally becomes necessary. On the other hand, the closing of the fields from September to the beginning of December, and then cutting for hay, nearly always guarantees a permanent high-producing stand.

Over-irrigation: This condition, with which is intimately connected poor drainage, soon causes a weakening of the lucerne and its final replacement by grass and weeds. In Vincent County there are many examples of much of the lucerne having been replaced by a more or less continuous turf of Poa pratensis and rye-grass. On many of the clay silts where hollows are present and the surface water cannot readily be removed this condition most frequently occurs, and is often accompanied by a spreading lucerne root-system within a few inches of the surface.

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

J. G. MYERS, B.Sc., F.E.S., R.A.O.U., Biological Laboratory, Wellington.

I. INTRODUCTION.

THE visitor to Salt Lake City, the capital of Utah, is impressed by a monument occupying a prominent position in the town. It is in the form of a simple Doric column surmounted by a granite sphere on which two white seagulls are in the act of alighting. On the base of the column is the legend—

SEA-GULL MONUMENT

ERECTED IN GRATEFUL REMEMBRANCE OF THE MERCY OF GOD TO THE MORMON PIONEERS.

In 1848, when the crops on which the early settlers were entirely dependent for the next season's food—crops nursed with infinite labour on an almost untouched desert—were threatened with total destruction by a plague of the black, short-winged grasshoppers (*Anabrus simplex*), ever since known as "Mormon crickets," huge flocks of gulls from breeding-places on islands in the lake descended on the infested fields —a veritable angelic host to the anxious settlers—and left scarcely a grasshopper alive.

One sometimes wishes a few such spectacular demonstrations of the value of our birds to agriculture could be arranged in New Zealand for educational purposes. The New Zealand farmer is a very staunch supporter of the adage that "seeing is believing," and, unfortunately, the absolutely indispensable services of bird-life are in this country almost entirely overlooked. In North America "the general utility of birds in checking the increase of injurious animals and plants is well understood"; in England and in Europe generally the value of birds is widely admitted; in Australia there is a rapidly growing recognition of the services rendered by them; but in New Zealand, although an exceptionally enlightened Government early saw the need for the wholesale protection of the indigenous birds, this was due rather to the

scientific interest and uniqueness of the Dominion's bird-life than to an estimate of its economic importance. New Zealand has long been accustomed to the idea of bird-protection (though in only too many backblock districts the laws have even been forgotten), but there may be a tinge of novelty in the conception that *bird-protection pays*. By this is meant not only protection in the passive sense as understood in the Dominion—the mere refraining from killing—but an active protection against enemies, and a provision of nesting-sites, nesting-boxes, and of food when scarce—a return, in fact, to the customs of older, more leisurely days and countries, where no corn was harvested without the hoisting of at least one sheaf on a pole as winter food for the birds. The writer is well aware that such proposals in the present state of public knowledge on the question almost savour of the ridiculous ; nor would some of them, under New Zealand conditions, be either necessary or desirable.

In the foregoing it will be noticed that the writer speaks of birds as a whole, generally and indefinitely, as though they were nearly all beneficial to man and his work. That is precisely the conclusion the writer wishes to demonstrate—that so far as the indigenous birds of New Zealand are concerned, with one possible exception, all are either beneficial or entirely harmless. With regard to the foreign birds introduced through misplaced sentiment or through fallacious opinions regarding their habits, although complaints have been received of practically every species except the hedge-sparrow, it will be immediately suspected from the foregoing remarks that in so far as concerns their relations to man and his crops they are by no means so black as they are painted. A case might be made out for even the house-sparrow. Many of the imported birds, other than game-birds, were introduced at a time when native pests, increasing phenomenally owing to the tremendous access of new food-supply in the shape of crops and to the driving-away of their natural enemies, the birds, by the burning of forest covert, were placing the early settlers in desperate straits. It must be admitted that to a certain extent they saved the situation, and that the present freedom from such wholesale infestation is in part due to their continued activity.

The protection of the indigenous birds of New Zealand is a matter which calls for the co-operation of every citizen of the Dominion. It is justified on the grounds of scientific uniqueness, of a wholesome sentiment, and of economic value. We are urged to the task by our duty to posterity, by our feelings, and by our pocket. Without the strong backing of enlightened public opinion laws are ineffective. In the very places where the birds are most in evidence the laws are the most difficult of enforcement.

It is hoped in a few popular articles in the *Journal* to demonstrate the general value of birds to man, and to examine all the commoner birds of New Zealand, both introduced and indigenous, to ascertain the specific part each plays in the struggle between the agriculturist and his environment.

The total number of species of wild birds in New Zealand is 234. Of these 209 are indigenous and the rest introduced. If from the indigenous birds we subtract firstly those which are far too rare to enter into economic relation with man, and secondly those, like certain

ocean-ranging species, whose haunts are distant from inhabited areas, we have, with the 25 introduced species, a total of 109 species of birds which are to be considered of more or less economic importance in New Zealand.

The relationships of birds to man may be classified as follows (taking no account of æsthetic values) :—

Beneficial: By destroying animal pests of crops or useful plants, or of domestic animals; destroying vegetable pests or weeds; distributing seeds of useful plants; supplying sport; supplying food; pollinating useful plants.

Injurious: By direct injury to man; direct injury to man's domestic animals; destroying or devouring crops or useful plants; destroying beneficial insects; injury to man's game animals; distributing seeds of weeds.

Of these the role of destroying the insect pests of crops and other useful plants is overwhelmingly the most important phase of bird activity. A noted author has drawn attention to the fact that in the economy of nature the two classes of animals which have attained the most complete mastery of the air—namely, the birds and the insects—are pitted against each other, and so delicate is the balance of power that were it not for birds insects would clear the vegetation from the face of the earth. When we remember that, according to Huxley's moderate estimate, the progeny of one female plant-louse or "green-fly" allowed to multiply unchecked for one year would produce a mass of plant-lice exceeding in bulk the population of China, and when we reflect that birds are the chief factors in preventing this result we are in a better position to estimate the importance of bird-life.

As was stated earlier, the vast majority of the birds are beneficial; but in the case of many of the introduced birds the pros and cons must be considered with care. Where the activities of a given species come under both beneficial and injurious categories it is very difficult to eliminate the personal equation. There are some birds which should be protected and encouraged in every possible way, while there are others which are beneficial when present in limited numbers, but apt to become injurious when unduly numerous. Others, again, are injurious in one district or at one season, and beneficial at another. Several kinds of birds, for example, do splendid service for the greater part of the year, but incur the emphatic condemnation of the fruitgrower during the brief period in which the fruit is ripe. It is hoped to keep the present inquiry as unbiased as possible, and to estimate fairly the proportion of benefit and injury in the activities of each species throughout the season and throughout its distribution.

The Cull Cow and Scrub Bull.—This subject was discussed at the meeting of the Board of Agriculture last month. The Board agreed that the proposal to make the licensing, branding, or spaying of unprofitable animals compulsory was not yet practicable, but that the agricultural and pastoral associations, herd-testing and breed societies, and dairy companies should be asked to assist in an active propaganda against the use of inferior animals as sires, and for the discouragement of the sale of cows as milkers when they had been found to be unprofitable. An article by Mr. A. R. Young, M.R.C.V.S., in a recent issue of the *Journal of Agriculture* on the question of the disposal of these animals was carefully considered and appreciation of it expressed.

THE POISONOUS, SUSPECTED, AND MEDICINAL PLANTS OF NEW ZEALAND.

(Continued.)

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

FILICES.

THE common bracken-fern of New Zealand (*Pteris aquilina* var. *esculenta* Hook. f.*), which in some of its varieties is almost cosmopolitan, has long been suspected of causing the death of stock in various countries other than New Zealand. If some of the other genera of this large family are examined it will be found that they are known to be poisonous. Pammel (1911) ("Manual of Poisonous Plants," p. 317) remarks that *Adiantum pedatum* (maiden-hair fern) is probably poisonous. "Male fern" (*Aspidium (Dryopteris) Filix-mas.*) is used as an official remedy in the British and United States Pharmacopœias, the rhizome "not kept more than a year" being the part employed as a vermifuge. In overdose it is a distinct poison, there being five fatal cases recorded with symptoms of vomiting, diarrhœa, vertigo, headache, tremor, cold sweat, dyspnœa (laboured breathing), cyanosis (blueness of skin), mania, coma, convulsions, amblyopia (impaired eyesight), or even amaurosis (loss of sight) with dilated fixed pupils often present. The loss of sight is usually temporary, but has proved permanent. Animals poisoned with male fern show parenchymatous nephritis (inflammation of kidney-tissue).

A case in which sheep were apparently poisoned by fern in the Auckland District is recorded in Volume i of this *Journal*, p. 215. Mr. A. J. Hickman, Veterinarian, reported visiting the locality of the mortality (on 9th March, 1910), and that out of a mob of seventy ewes and three hundred lambs, twelve ewes and eighteen lambs had died. No symptoms were observed during life; the animals were simply found dead, having apparently died without a struggle. The owner suspected anthrax. The deaths occurred about forty-eight hours after the sheep had been put into a paddock that had twice been sown with turnips. No roots had, however, matured, and there was nothing to be had but fern-shoots and sorrel. Post-mortem examination showed the visible mucous membranes pallid; no discharge from nostrils, mouth, or anus. Carcases were in good store condition. Decomposition was fairly advanced throughout, and there was much post-mortem staining on both pleura and peritoneum. The rumen was normal and distended with gas, and full of semi-digested fern-fronds, and apparently nothing else. There was no detachment of the mucous membrane, and no signs of inflammation. The other three stomachs—reticulum, omasum, and abomasum—all normal. Spleen normal. Liver very pallid and softened, but not enlarged. The large and small intestines were normal, the colon containing a few free parasites (strongyles). The lungs were engorged with blood, and dark in colour.

* It should be noted that *Pteridium* is the more modern generic name used by botanists to denote the genus to which the common bracken belongs, though *Pteris* is perhaps as frequently used.

The late Mr. J. G. Clayton, M.R.C.V.S., in June, 1904, investigated a case of sudden mortality in a number of eighteen-months-old Shorthorn heifers at Weber, which were in good condition up to three weeks of death. They were running on a block of 600 acres, and had been on for some months. In February 200 acres of the block had been burnt and sown in English grasses, which had taken badly, small fern being the predominant growth. The heifers were generally on the burn, very seldom going on to other parts of the block. Towards the end of May the owner noticed one heifer dead, but did not attach much importance to it owing to the rough nature of the country. He then went away from his farm for about ten days, and on his return he could not see any cattle alive. He found four dead; after further search the bodies of eleven altogether were found, and it was concluded that the rest had died in the bush. No symptoms were observed, and as the animals had been dead about ten days before being inspected no satisfactory post-mortem examination could be made. All that were examined showed the kidneys to have been affected. In some cases the structure was completely broken down, like damson-pulp. The spleens were normal, and anthrax was certainly not the cause of death. In the Veterinarian's opinion the cause of death was to be found in connection with the burn.

Lander (1912) summarizes the results of inquiry by the officers of the English Board of Agriculture in 1909 and 1910. An editorial article in the *Journal of Comparative Pathology* of 1894, p. 165, draws attention to the important features of bracken disease which serve to distinguish it from anthrax. The absence of bacilli in the flesh fluids and tissues, the normal spleen, the subpleural and subperitoneal hæmorrhage, considerable effusion of blood in the large intestine, a temperature of 106·8° to 108·4°, the disease lasting a few days with abundant bloody discharge from nose and rectum, and the disease occurring only in cattle, are symptoms which serve to distinguish bracken poisoning from anthrax. The symptoms which are mentioned in the English official reports for 1909 as symptomatic of bracken poisoning are loss of appetite, blood-tinged discharge from mouth and nose, blood from bowels, pallor of membranes of eye, great depression, and coma and death in twelve to seventy-two hours after the onset of the symptoms. The lesions include congestion of the pulmonary membranes and small hæmorrhages in the substance, congestion of the stomach and intestines, the wall of the latter being in some parts deep red and thickened by infiltration of blood, blood also being present in the lumen of the intestine. Areas of diphtheritic inflammation and distinct ulceration may be present in the stomach and intestines; the serous membranes show hæmorrhages in their substance, and there are hæmorrhages in the heart and body-muscle and under the skin.

Sir Stewart Stockman (1918), of the English Board of Agriculture, carried out further experiments (*Journal of the Board of Agriculture*, March, 1918) in which direct evidence was obtained of the poisonous nature of fresh fronds of the English bracken by feeding experiments. A bull calf over a period of twenty-nine days received approximately 260 lb. of the fronds of green bracken (about 10 lb. per day with other food). This had a fatal termination. The animal showed identical symptoms during life and identical lesions on post-mortem examination to those seen in cattle dying in the field of suspected bracken poisoning.

It is concluded to be not improbable that bracken contains a small amount of a poison which is able to accumulate in the system and which requires a certain time to produce its full effect, after which severe illness may begin in an explosive manner, possibly some weeks after the poison has been withheld. It seems probable from practical observation that individuals vary in susceptibility, since some cases develop later than others in the same herd ; some animals on the same pasture even seem to be highly resistant, and may not show the least sign of illness, while others are dying around them. It is at least possible that the former animals have acquired resistance by a natural process of immunization, as may happen in the case of poisons of the ricin class, and only those succumb which have too brusquely and continuously fed upon the poisonous substance, with the result that they are fatally attacked before the acquired resistance can establish itself. The article concludes that no time should be lost in changing a herd showing symptoms of fern poisoning on to pasture containing no fern.

Hadwen and Bruce (1920) (see abstract in *Experiment Station Record*, Oct., 1920, p. 471) record the results of their observations on the results of the consumption by horses of common bracken (*Pteris aquilina*) on the Pacific slope of British Columbia. Feeding experiments were made with the dried fern. From these the authors concluded that it can be assumed that an addition to the daily diet of about 6 lb. of dried bracken will kill a horse in about a month.

W. E. Lawrence (1922) ("Principal Stock-poisoning Plants of Oregon," Station Bull. 187, Oregon Ag. College), dealing with the common bracken-fern of that State (*Pteridium aquilinum pubescens* Underw.), states that the symptoms known as fern-staggers in horses are undoubtedly more common than any other trouble caused by poisonous plants in western Oregon. The trouble is confined almost entirely to horses, though there are occasional reports that cattle have been poisoned by this fern. It is noteworthy that in these last two countries, both on the Pacific slope of North America, the mortality should be caused by the dried fern fed as an impurity in the hay, the difficulty being in many localities to harvest the hay without contamination with much bracken. Ferny hay is usually rated dangerous when it contains about one-third of the common bracken. It usually requires about a month of feeding upon ferny hay to cause fern-staggers, which is most common in dry years. Horses are known to acquire a taste for the fern after the initial dislike has been overcome, at which stage even bedding with fern must be discontinued, for the horses will then eat the bedding.

Mr. C. C. Empson, when Stock Inspector for the Nelson District, assured the writer that fern poisoning in cattle was prevalent in his district in the winter, when the young fern is coming through the ground from March until June, especially in the latter month, and even as late as September. The symptoms he records are gradual emaciation and anæmia, the animals being almost bloodless when killed or when they die ; and they pass a good deal of blood up to the time of death. A beast will acquire a taste for the fern, and even if put on to good grass will return to the fern if it is possible to do so. The droppings are often mixed with blood-clots. After a burn cases are more prevalent, and it is very difficult to pull cattle round when once they are badly affected.

PASTURE TOP-DRESSING EXPERIMENTS AT TE KUITI.

TWO SEASONS' RESULTS.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

In the *Journal* for May, 1922, was published an article giving the first season's results of trials with phosphatic fertilizers carried out on Mr. Charles Harrison's farm at Te Kumi, about two miles from Te Kuiti. The plots were set out in 1921, on permanent pasture which had been laid down about eight years, and had received no fertilizer for at least five years previous to the dressings, which were applied on 8th and 9th September, 1921. Reviewing the first year's results judged on the weight of hay produced, superphosphate (on the unlimed areas) gave by far the highest yield, with finely ground raw rock phosphate and basic slag about equal. On the limed areas superphosphate gave a slightly better yield than on the unlimed, while the raw ground rock phosphate gave a comparatively poor result. It was pointed out then that experience to date in the Auckland Province showed that lime used with raw rock phosphate did not produce good results.

YIELD OF HAY.

The plots were top-dressed again on 18th and 19th May, 1922, and shut up for hay on 9th October following. They were cut and weighed during the first fortnight in January last. The average of results covering the two years' trials is given in the following table :—

Fertilizer used.	Amount per Acre.	Yield of Hay per Acre: Mean Average of Three Plots.				Increase due to Fertilizer.				Percentage Increase due to Fertilizer.
		Tons.	cwt.	qr.	lb.	Tons.	cwt.	qr.	lb.	
Unlimed.										
Check	No manure	1	3	0	1		..			..
Basic slag ..	3 cwt. ..	1	12	2	2	0	9	2	1	41·3
Superphosphate ..	3 cwt. ..	2	3	0	6	1	0	0	5	87·1
Rock phosphate ..	3 cwt. ..	1	11	1	22	0	8	1	21	36·7
Limed.										
Superphosphate ..	3 cwt. ..	2	0	0	17	0	17	0	16	74·5
Rock phosphate ..	3 cwt. ..	1	7	2	16	0	4	2	15	20·1

On the weight of hay, taking the average yield of the two seasons, superphosphate (on the unlimed areas) has given the highest yield, having produced an increase of approximately 87 per cent. over and above no manure, while basic slag has increased the yield 41 per cent., and raw ground rock phosphate 37 per cent. On the limed area the yield of hay from superphosphate was 75 per cent. over and above the area which received no manure, while rock phosphate only gave 20 per

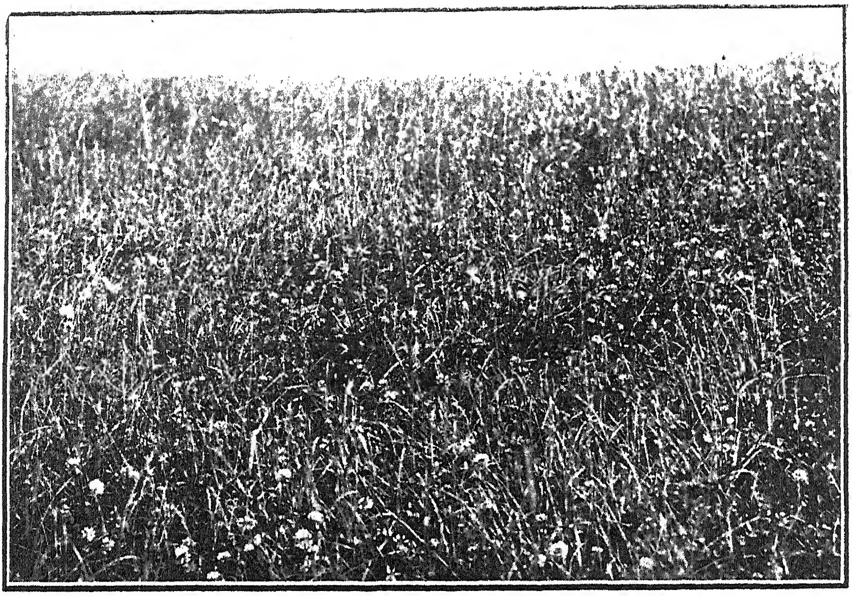


FIG. 1. PART OF SUPERPHOSPHATE PLOT ON THE LIMED AREA, SHOWING DENSE GROWTH OF GRASSES AND CLOVERS.

FIG. 2. ROCK-PHOSPHATE PLOT ON UNLIMED AREA, SHOWING CLOVERS AMONG COCKSFOOT AND RYE-GRASS; YORKSHIRE FOG COMPARATIVELY ABSENT.

cent. increase in yield. This furnishes further evidence that raw ground rock phosphate when put on soil recently limed gives comparatively poor results. On the other hand, superphosphate applied to the soil which had been limed the previous season gave satisfactory results.

To value the action of the fertilizers in terms of weight of hay only is not satisfactory. Though great care is taken to get reliable results, there may be a considerable variation in the percentage of moisture contained in the hay at the time it is weighed. Apart from that, the improvement effected on the pasture by the fertilizer is a most important consideration, and cannot be estimated by the weight of hay produced. Shutting up and allowing the pasture to grow for hay does considerable harm to the pasture for grazing; also many weeds are favoured. Cocksfoot is induced to grow tufty, and white clover suffers through being shaded. These are often important constituents of a permanent pasture, and such is the case with the pasture on which these experiments are being conducted.

IMPROVEMENT IN PASTURE.

The plots considered from the point of view of improvement of the pasture show some important results. On inspection made before haying the areas on which superphosphate and lime had been applied stood out strikingly. The colour of the pasture was a rich healthy green, and the bottom growth dense, due principally to the large proportion of white clover and trefoil (suckling-clover) present. Cow-grass growth was strong also. Alongside the superphosphate-lime plots were those which had received raw ground rock phosphate and lime. On the latter the grasses and trefoil were pale in colour and starved-looking, while the general growth, as shown by the yield of hay, was poor. It had, however, improved a good deal since last season. On the unlimed area the plots which received superphosphate produced a vigorous growth. This fertilizer stimulated weeds as well as grasses and clovers. Yorkshire fog was abundant and luxuriant where super was applied, while alongside in marked contrast were slag plots with very little fog present. The line dividing the areas before the grass was cut could be distinguished by the presence of fog on the superphosphate and its comparative absence on the slag plots. There has been a decided general improvement on the slag plots. The areas which received raw ground rock phosphate but were not limed showed a good growth of grass, while cow-grass and white clover had also responded very well. Fog was not conspicuous as on the superphosphate plots. On the check plots, which received no manure, the clovers were hardly seen, while bracken-fern was well distributed over the areas. The general growth was poor. A considerable amount of sweet vernal and weeds were present.

The accompanying photos give a fair idea of the various features of growth. They were taken just prior to cutting the areas for hay.

GENERAL.

The results here recorded can be regarded only as progress results, and more definite conclusions cannot be drawn until after the trials have been continued over at least five years. Moreover, a summary of

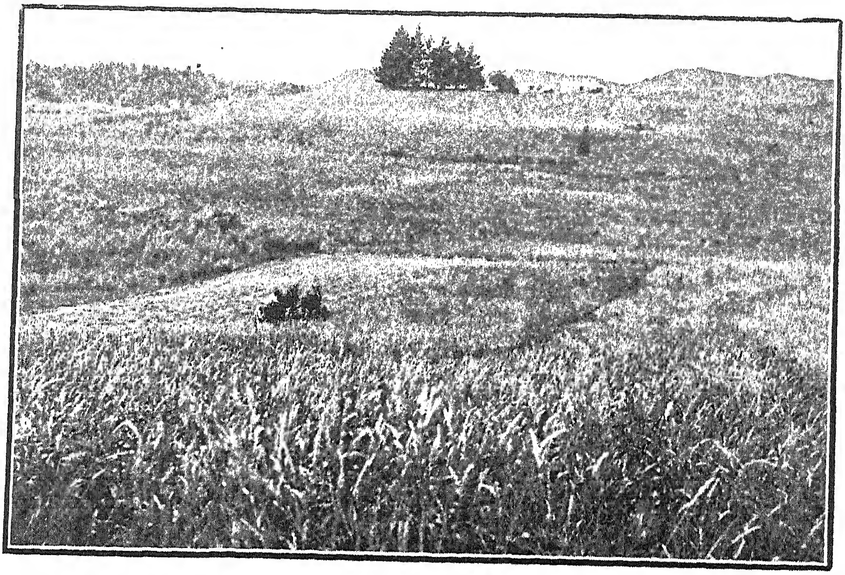


FIG. 3. SHOWING GROWTH OF YORKSHIRE FOG ON SUPERPHOSPHATE PLOT (UNLIMED AREA), ON RIGHT OF PHOTO.

The basic-slag plot may be seen between the superphosphate plot and the plot which has been cut.

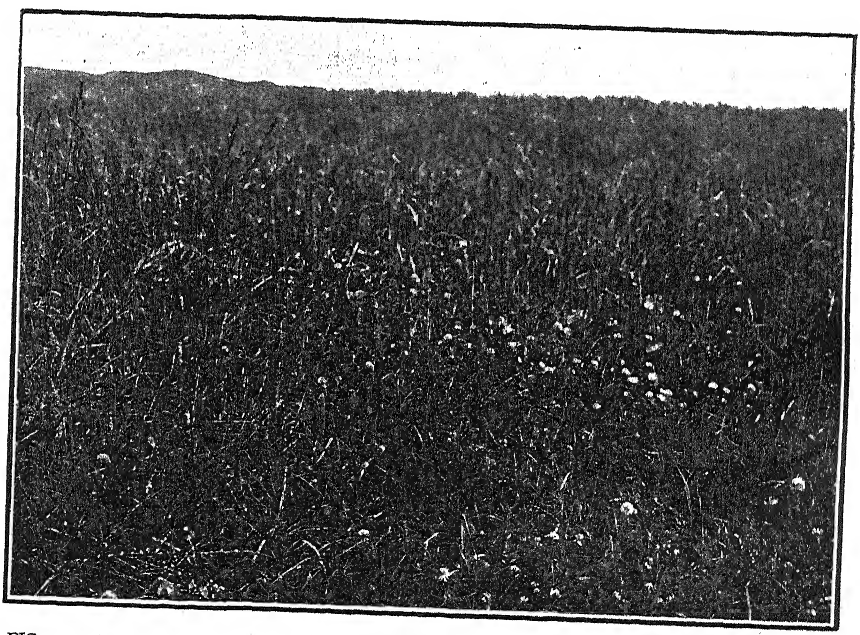


FIG. 4. BASIC-SLAG PLOT, SHOWING GOOD GROWTH OF CLOVERS (COW-GRASS AND WHITE CLOVER); COCKSFOOT ALSO NOTICEABLE.

such trials in different districts will give a better idea of the value of the various fertilizers used. As the Te Kumi area here dealt with possesses a light soil on undulating country, representative of thousands of acres of land in the King-country, Waikato, and near-by districts, the results gained to date should, however, be of considerable assistance in guiding farmers. The response to top-dressing with phosphatic fertilizers is so marked that it undoubtedly pays to use such an immediate and effective means of improving pastures. Viewing these interim results, covering two seasons only, it would appear that basic slag is not uniform in its good effects as a top-dressing for pastures. On heavier soils, in moister situations, the results obtained in Auckland Province show to the favour of basic slag and the more slowly soluble

FIG. 5. CHECK PLOT (NO FERTILIZER), WITH MARKED ABSENCE OF CLOVERS.

fertilizers. The point for farmers to note is that fertilizers should be selected according to the soil, the situation, and other factors which have an important bearing on results secured.

In the control of bracken-fern fertilizers help by improving the pasture so that more stock can be carried, and consequently the extra tramping and grazing keep down the fern. Apart from the extra bulk of material produced, and the change brought about in the botanical composition of the pasture, the feeding-quality is improved. This last fact should not be overlooked by farmers.

Analyses of the fertilizers used for top-dressing the test plots were given in last year's report. There were practically no variations in this year's analyses.

WEATHER RECORDS.

Rainfall exercises an important influence on the efficacy of slow-acting phosphatic fertilizers. The following is the record for Te Kuiti during the period of the tests (from data supplied by Mr. Hamblyn, Bank of New Zealand, Te Kuiti) :—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Rainfall (Inches) and Number of Wet Days, 1921.												
1·97	2·26	1·86	3·67	2·30	7·16	7·14	4·40	3·51	10·32	4·65	7·50	56·80
13	7	9	10	13	17	18	14	13	21	14	17	166
Rainfall (Inches) and Number of Wet Days, 1922												
2·93	5·69	6·99	3·78	3·20	2·72	2·52	7·39	2·87	6·14	6·95	2·67	53·85
14	7	18	16	15	10	8	18	9	14	15	17	161

The mean average rainfall for Te Kuiti taken from records covering ten years ending 1922 was 60 in. The year 1919 was omitted because the record was not obtainable.

WILD WHITE CLOVER IN GREAT BRITAIN.

THE following notes are contributed to the *Journal* by Mr. R. McGillivray, of the Agricultural Instruction Branch of this Department, who is at present on furlough, taking a course in agriculture at Reading University, England :—

Wherever in Britain farmers congregate and pastures are discussed one hears the merits of wild white clover extolled. It appears to be the unanimous opinion that it is a plant justly entitled to a conspicuous place in agriculture, and of great importance to the grazier on the downs and hill country. It is contended that its fattening properties excel by far those of ordinary white clover. This view is upheld by some of the most prominent professors attached to the various faculties of agriculture.

Botanically wild white clover does not differ from the cultivated form of *Trifolium repens*. There is, however, under field conditions an appreciable difference in growth and appearance. The writer has visited pastures in various parts of England and Scotland, and in Berkshire had the somewhat rare opportunity of seeing an area of wild white and ordinary white clover growing side by side, these having been sown in 1921 in adjoining blocks, at the same time, and under exactly similar conditions in every respect. The difference in general appearance between the two clovers was evident to even the most casual observer. At the time of visit, in September, the ordinary was flowering luxuriantly, while the wild white had only a scattered inflorescence, and at a short distance gave the impression of being a distinct variety. The wild clover was a much smaller plant, more stoloniferous, with leaves darker in colour, and smaller than the other. The flower-stalks were also much shorter, and more erect in habit, and the plants had completely covered the soil with a mat of rich green herbage, while in the case of the ordinary white clover there were still bare patches to be seen.

In Scotland and the North of England it is claimed that the wild clover is much hardier and more frost-resistant than the ordinary kind. The writer's investigations on this point were carried out in the South of England, where the past winter has been of a mild description, and so nothing definite was ascertained regarding hardiness. The experience of farmers in many parts is that the life of ordinary white clover is short, but wild white clover has only to be sown once, and invariably the pastures where it has been included in the mixture improve with age. Marvellous results have been obtained on the old wild-white-clover leas on the heavier soils by top-dressing with phosphatic fertilizers, especially those of a basic nature.

This clover has attracted attention for many years. The late Martin Sutton, of the firm of Sutton and Sons, Reading, initiated experiments with it as far back as 1854, and placed on record his views regarding its value. It was not, however, until 1886 that the first public experiments were carried out. In that year the Royal Manchester, Liverpool, and North Lancashire Agricultural Society commenced pasture tests on the Right Hon. W. E. Gladstone's Hawarden Estate, in Flintshire. Acre plots of various grass and clover mixtures were laid down, and in a few years' time it was observed that all clovers had disappeared except wild white. It proved so successful in these tests that the experiment had a far-reaching influence not only in the immediate neighbourhood, but in many other parts of the country.

In recent years the University College of North Wales instituted a number of pasture experiments in centres within the counties served by the college. In one plot only in each experiment was wild white clover included in the mixtures. The college report states that thirty months after sowing nine times more ground was covered by white clover where the wild seed was sown than was the case where the same quantity of ordinary white was used. The experiments conducted at Cockle Park, in Northumberland, by Professor Douglas Gilchrist, and also those by Professor Somerville, of Oxford University, proved conclusively that this clover can be successfully and economically established on poverty-stricken soils where other clovers refuse to grow at all.

Wild white clover is a somewhat shy flower, and is therefore not a bountiful producer of seed. Some farmers in Kent informed the writer that they considered themselves fortunate to get 40 lb. of seed per acre, but it is stated on reliable authority that about 75 lb. per acre is obtained on an average. The total amount of seed saved in Great Britain is estimated not to exceed about 90 tons per annum. The price is high. The grower realizes on an average from 14s. to 16s. per pound, and as an indication of the popularity of the strain it may be mentioned that even at the high price it commands retail there is never any carry-over of seed, as the supply has never yet met the demand.

The scarcity of seed has raised the question of growing it under cultivation for seed-production. This proposal has been condemned as likely to impair the hardiness and permanency of the strain. The best seed comes from the south-eastern counties of England, and also from the Cotswold Hills, in Gloucestershire, from pastures that have been down for many generations.

NOTE.—Interested readers are referred to notes on wild white clover in relation to New Zealand, which appeared in the *Journal* for August, 1920 (p. 83), and September, 1921 (p. 162).—EDITOR.

TWO FUNGAL DISEASES OF THE BLUE LUPIN.

K. M. CURTIS, M.A., D.I.C., D.Sc., Mycologist, Cawthron Institute of Scientific Research, Nelson.

DURING the present season two fungal diseases have been found in blue lupin (*Lupinus angustifolius*). This plant is cultivated for seed in various places in the Nelson District in order to supply the demand for the cover-cropping of orchards. Although most of these areas under cultivation are small and widely separated from one another, both diseases are usually present in them. The main factor governing the distribution and virulence of the diseases in a field is the presence of moisture, both in the soil and in the air immediately above it. As a rule the plants grow sufficiently close together for their tops when mature to form an unbroken, interlacing mass of branches and foliage, shutting off from the region of relatively still air round the stalks both sunlight and drying air-currents. When the soil is moist, after rain or through lack of drainage, the air in this enclosed region becomes charged with moisture, and spores of fungi there find conditions ideal for germination and infection.

Although the two diseases usually occur together, as a rule one predominates, the commoner of the two being that caused by the fungus *Botrytis cinerea* Pers. Both diseases are typically stem troubles, but occasionally one or more of the branches becomes infected, while the stem may remain healthy. When the lesion occurs on the stem the symptoms of disease are striking, and are exhibited by the whole of the upper portion of the plant; but when a branch only is diseased the symptoms are shown locally, and under casual inspection may escape notice.

The two diseases will now be treated separately in detail.

1. LUPIN-WILT CAUSED BY *BOTRYTIS CINEREA* PERS.

This disease is economically the more important of the two, as it attacks particularly cultivated, as compared with self-sown, lupin. When a severe attack takes place on the stem the upper portion of the plant gradually wilts, and the leaves lose their green colour, become yellow, and eventually fall, leaving the crown of the plant bare. If the plant is of vigorous growth when attacked the upright habit of the stem is usually maintained till death, but in weak, self-sown plants the stem may bend at the point of infection and the plant fall.

When the branch is the part infected the wilt and fall of the leaves take place as a rule only on the branch concerned, as might be expected, since the derangement of the supply of nutritive substances is only local. The lesions on the stem are usually to be found at soil-level, but they may occur up the stem to a height of about 2 ft. (Fig. 1). They vary in length from ½ in. to 9 in., according to the virulence of the attack and the time the fungus has been at work. Shortly after infection takes place the epidermal cells of the plant become brown in colour, and the diseased area assumes a slightly transparent appearance. The edge of the resulting diseased area shows at times an abrupt

rise in level as it merges into the healthy region. This characteristic can be seen at the left-hand end of the lesion shown in Fig. 2, but it is not of constant occurrence. The disease as a rule extends completely round the stem, and the outer tissues of the plant become permeated with the vegetative hyphæ (strands) of the fungus.

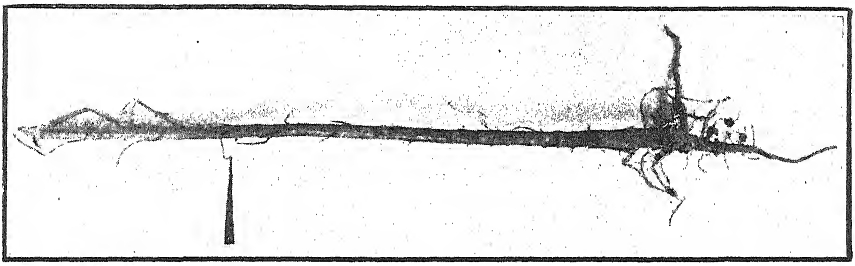


FIG. 1. STEM OF BLUE-LUPIN PLANT ATTACKED BY BOTRYTIS CINEREA. ARROW INDICATES LESION.

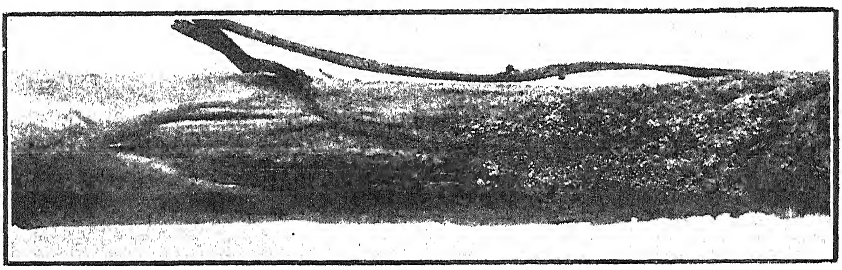


FIG. 2. VIEW OF LESION INDICATED IN FIG. 1. NATURAL SIZE.

[*Photos by W. C. Davies.*

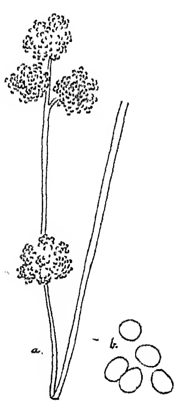


FIG. 3. CONIDIOPHORE (*a*) AND CONIDIA (*b*) OF BOTRYTIS CINEREA. (*a*) × 75; (*b*) × 240.

As time elapses, the lesion becomes larger, and eventually conidia (spores) (Fig. 3 *b*) are developed over its central region and to within a short distance of the margin. The conidia are minute, unicellular, oval bodies borne in clusters on tall branched conidiophores (Fig. 3 *a*). The latter are hyphæ that rise more or less perpendicularly into the air from the vegetative hyphæ in the plant. The conidiophores are black in colour and of considerable length, and as the conidia are shining white the general effect to the naked eye of a tuft of conidia on their conidiophores is of a whitish-grey furry mass (Fig. 2). The conidia, on an average, measure about $12{\cdot}5 \times 9{\cdot}5\ \mu$ ($\mu = \frac{1}{1000}$ mm.), and, when moistened, separate readily from the conidiophore. They are borne by wind or on the bodies of insects, or are washed by

rain, to other portions of the same or another plant. They germinate when moisture is present, and in a few hours give rise to one or more vigorous germ-tubes, which in turn infect any suitable plant-tissue with which they come in contact.

The production of conidia on a lesion ceases after a time, and the conidiophores gradually die down upon the plant-surface, revealing as they fall away the young sclerotia already developing at their bases on the stem of the plant. Sclerotia are small black bodies composed of compactly interwoven hyphæ, and are capable of remaining unharmed in a resting condition for considerable time, and so of ensuring the

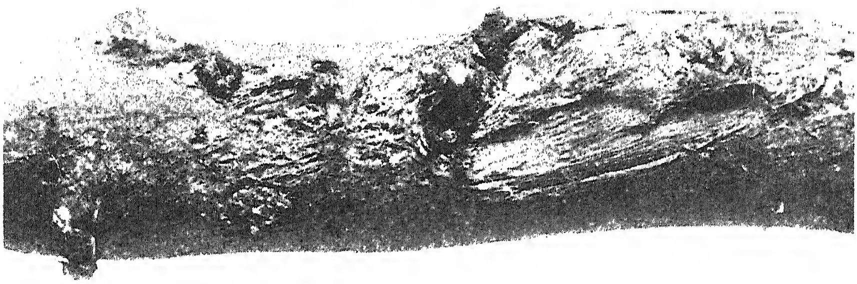


FIG. 4. SCLEROTIA OF BOTRYTIS CINEREA IN RESTING CONDITION. NATURAL SIZE.

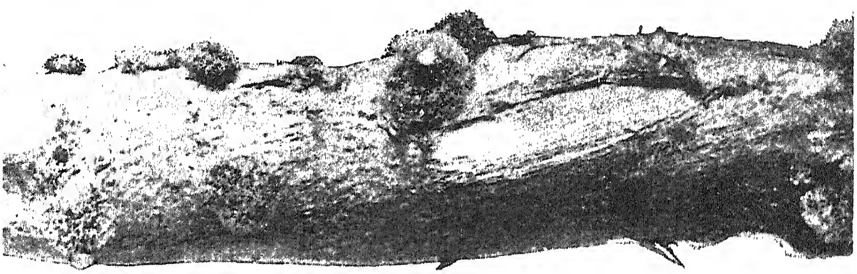


FIG. 5. CONIDIA PRODUCED BY THE SCLEROTIA OF FIG. 4. NATURAL SIZE.

[*Photos by W. C. Davies.*

persistence of the fungus from season to season. They are hard in texture, roughly oval in shape, and vary in length from 1 mm. to 5 mm. When they are small their surface is more or less smooth, but in large specimens it is usually thrown into rounded lobes (Fig. 4).

Although sclerotia can remain dormant for months, if conditions are favourable they may give rise to conidia shortly after they are formed without an intervening period of rest. In Fig. 4 are shown several sclerotia, chiefly of the larger convoluted type. The lupin of the photograph bore them at irregular intervals from the junction of stem and root to a height of 8 in. up the stem. The remains of some of the superficial vegetative hyphæ of the fungus may still be seen in this photograph, below the two large lower sclerotia. The lupin bearing

them was kept dry for several weeks, and then moistened and kept in a saturated atmosphere. In forty-eight hours the sclerotia gave rise to the masses of conidia shown in Fig. 5. The two photographs show as nearly as possible the same part of the stem, and the position of the tufts of conidia of Fig. 5 will be found to correspond to that of the sclerotia of Fig. 4. Fig. 6 is an enlarged view of one of the sclerotial-borne tufts. The conidia and conidiophores formed on sclerotia are similar in structure to those formed on the lesion earlier in the progress of the disease (Fig. 3).

Under natural conditions the sclerotia fall to the ground on the decay of the diseased plant, and there they remain until the following spring, when with the advent of rain and warm weather they break forth into new growth, giving rise to their crop of conidia. These infect lupin-plants of the new season, and the persistence of the fungus into a second year is thus secured.

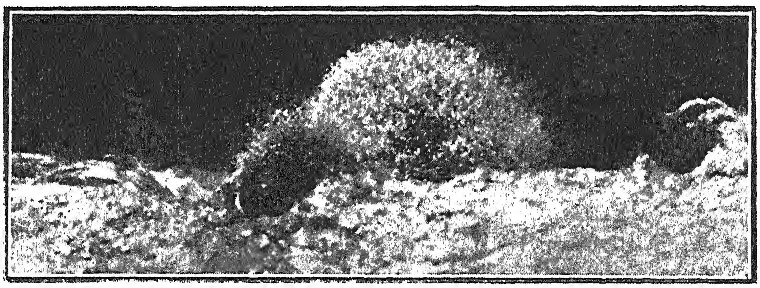


FIG. 6. SINGLE TUFT OF SCLEROTIAL CONIDIA OF BOTRYTIS CINEREA. × 4.

[*Photo by W. C. Davies.*

II. LUPIN-WILT CAUSED BY *ASCOCHYTA PISI* LIB.

This disease occurs more often on self-sown than on cultivated lupin, and seems to attack particularly the weaker plants that have fallen behind in the struggle for light.

The attack may take place, as in the previous disease, at soil-level, but as a rule the lesions occur higher on the stem. One large lesion only may be present, but it is frequently accompanied by several smaller ones above or below it. Branches are occasionally infected, the stem of the plant at the time remaining healthy in some cases and in others becoming diseased. The general symptoms are similar to those exhibited by the plant when infected with *Botrytis cinerea* Pers., but as the plants as a rule are weakly when attacked the disease is more aggressive and the plants quickly succumb.

Fig. 7 shows two stages of attack of *Ascochyta Pisi* Lib. on lupin. The arrows indicate the position of the lesions. In the larger plant the lesion is small, and the plant still retains its crown of green foliage. The smaller plant has been attacked in two places on the stem, and the presence of the disease is indicated by the loss of most of the leaves, and by the change of colour and death of those that are still attached.

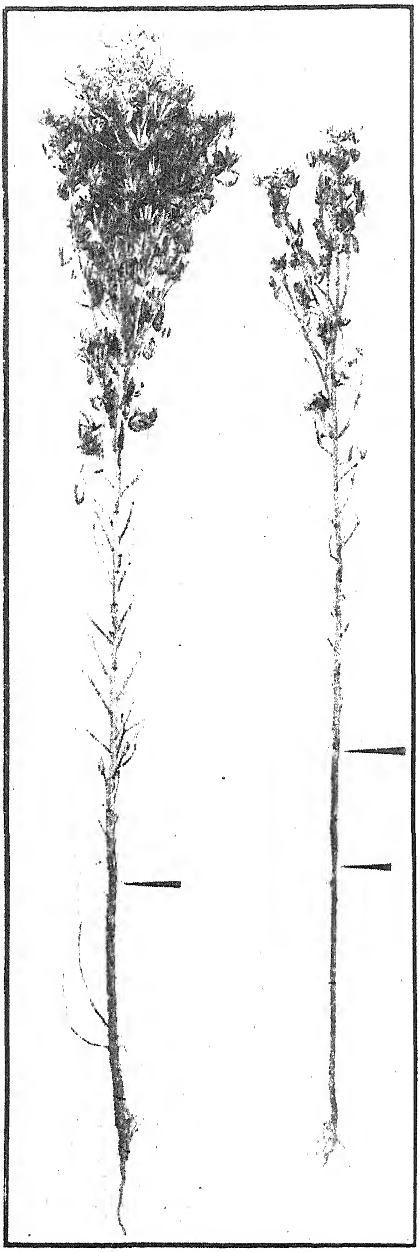


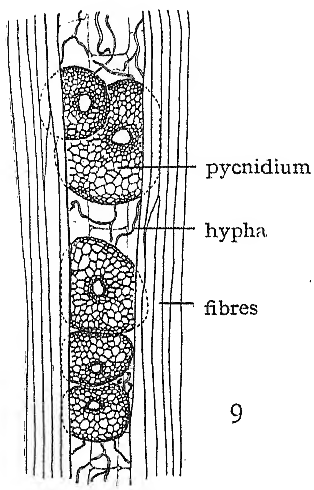
FIG. 7 (LEFT). BLUE-LUPIN PLANTS ATTACKED BY ASCOCHYTA PISI. ARROWS INDICATE LESIONS.

FIG. 8. VIEW OF A LESION INDICATED IN FIG. 7. NATURAL SIZE.

[*Photos by W. C. Davies.*

The larger lesions vary in length from 6 in. to 18 in. and completely girdle the stem, while the numerous small lesions accompanying them may be only about ¼ in. in diameter and more or less circular in outline. There is no sharply marked margin to the lesion, for the dark-brown colour of the diseased region merges gradually into the normal colour of the stem. Nor is there in this disease an abrupt change in level at the junction of diseased and healthy tissue.

As in the *Botrytis* disease, the vegetative hyphæ invade the outer tissues of the stem or branch and cause their death. After a certain time spores are produced. In the present case, however, they are not formed freely on the surface as conidia, but are enclosed in minute black chambers buried just beneath, but opening by a pore on to, the surface of the host plant. If the epidermis of a lupin-stem be removed the tissue lying immediately beneath it will be found to consist of



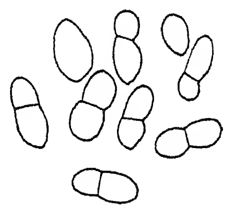


FIG. 9, PYCNIDIA (× 58), AND FIG. 10, SPORES, (× 750), OF ASCOCHYTA PISI.

strands of fibres running parallel to one another down the stem. Each strand is separated slightly from its neighbour, the narrow intermediate region being occupied by thin-walled cells. It is down these rows of soft tissue separating the fibrous strands that the pycnidia, or chambers in which the spores are produced, are formed. As the pycnidia attain their full size they push up the epidermis covering them, causing it to fall away and leave exposed the corrugated light-coloured surface of the fibres. Before the epidermis is burst away, however, the presence of pycnidia beneath it may be detected by the occurrence of small ruptures in the epidermis about the size of a pin-prick. These ruptures are due to the projection of the mouths of the pycnidia through the epidermis.

In Fig. 8 is shown a lesion from part of which the epidermis has broken away. Between the strands of fibres in the region where there

is no epidermis a few pycnidia are to be seen, and above and below this region are numerous pycnidial mouths projecting through the still intact portion of the epidermis. A surface view of pycnidia under magnification may be seen in Fig. 9. They are lenticular in shape, and are usually slightly depressed in the region round the mouth, which is of considerable size. Occasionally compound pycnidia are to be found. These are larger than normal, and have two or three mouths, although not usually more than three.

The wall of the pycnidium is composed of small angular cells, and lining its interior are great numbers of spores (Fig. 10). The spores average about 10·5 × 5 μ in size, are hyaline in colour, rather pointed, oval in shape, and are slightly constricted at the junction of the single cross-wall and the outer wall.

When a pycnidium containing mature spores is moistened the spores become free and ooze in numbers from the mouth in a long thread-like mass that coils irregularly upon itself as it emerges into the open. The spores are now free on the surface of the plant, and their distribution is usually completed by the agency of water.

The species of *Ascochyta* that occurs on lupin resembles closely *Ascochyta Pisi* Lib., which attacks peas, beans, and vetches, all of which host plants are relatives of the lupin. The similarity of the fungi and the relationship of the host plants suggest strongly that the species on lupin is the same as that on the pea, and that the organism has merely spread to another host plant. The suggestion is supported by the fact that when peas and lupins occurred near each other, and the peas were attacked by *Ascochyta Pisi* Lib., the lupin was found to be attacked also. The species on blue lupin is therefore regarded, at least temporarily, as *Ascochyta Pisi* Lib. (*Mycosphaerella pinodes* (B. & Blox.) Niessl.).

REMEDIAL MEASURES.

The chief precaution that can be taken against both diseases is to avoid planting lupin in damp situations. If badly drained soil cannot be avoided the difficulty may be partly overcome by guarding against overcrowding of the plants, so that when they are full-grown circulation of air can take place round the stalks. Seed for planting should be taken from healthy fields only. Should either disease establish itself firmly in a field, rotation of crops is desirable.

New Rabbit District.—The constituting of the Puketoi Rabbit District (Akitio County) under Part III of the Rabbit Nuisance Act, 1908, is gazetted.

Wheat and Oats Threshings.—Returns of actual threshings received to the 21st March by the Government Statistician from millowners showed that until then 1,142,538 bushels of wheat and 688,846 bushels of oats had been threshed out. The average yields per acre in cases where particulars of areas were furnished (covering 98 per cent. of total threshings) worked out at 35·59 bushels for wheat and 37·81 bushels for oats. The figures for the Canterbury and Otago Land Districts respectively were as follows: Canterbury—Wheat, 1,009,918 bushels threshed, averaging 36·04 bushels per acre; oats, 600,631 bushels threshed, averaging 37·74 bushels per acre. Otago—Wheat, 56,802 bushels, averaging 31·43 bushels per acre; oats, 35,149 bushels, averaging 39·18 bushels per acre.

CONTAGIOUS VAGINITIS IN COWS.

W. C. BARRY, M.R.C.V.S., Veterinarian, Auckland.

A LARGE number of cases of contagious vaginitis among dairy herds have come under notice of the Live-stock Division during the past season, and many inquiries relative to the trouble have been received. A short description of the condition, together with an outline of treatment, should therefore be useful, especially to dairy-farmers.

Vaginitis, or inflammation of the vagina (passage leading to the womb), is sometimes referred to as "vaginal catarrh." The latter name, however, is not a good one, for the reason that a catarrhal discharge, although often present, is not a constant symptom of the trouble, and may arise from some abnormal condition of the uterus having no connection with the disease under consideration. Various organisms have been mentioned by bacteriologists as giving rise to vaginitis, but so far as I am aware the specific cause is not yet determined.

SYMPTOMS.

Clinically the most important symptom of vaginitis is sterility, the cow not "holding" to the bull but returning again and again at irregular periods. In this respect it is second only to abortion disease as a source of loss and inconvenience to the dairy-farmer. The cow, as a rule, presents no other noticeable symptom beyond failure to hold to the bull. Where this condition exists in herds in which no cases of abortion have occurred (recognizing abortion disease as a common cause of sterility) an examination of the vaginal passage should at once be made. This is done with the cow standing in the bail. The external lips of the passage (vulva) are retracted with the fingers and the condition of the interior noted. The healthy membrane is of a rose-pink colour, with a smooth, glistening surface. When inflamed it presents a red, deeply congested appearance, while on the surface may be observed small elevations, often not larger than a pin-head, which feel to the finger like grains of shot under the membrane. Occasionally a small ulcerated patch may be seen, and very often flakes of a pus-like discharge are present. The part is intensely irritated, and the cow generally resents the manipulation. According to the nature of the eruptions, "vesicular," "granular," and "nodular" forms of the disease have been described, but for practical purposes of treatment these do not require differentiation. In making the examination the hindquarters of the cow should be exposed to a good light. If in a dark shed an electric torch is useful, as the condition may readily escape observation if looked for in a bad light.

Vaginitis may assume either an acute or chronic character. The long-standing cases present the most difficulty in treatment. Adhesions occasionally form between the walls of the vaginal passage, and it is likely that in old cases the lining of the womb itself becomes involved.

The desire for the male in affected cows appears to arise from the irritable condition set up, and is not the result of true "bulling."

We have seen cases of vaginitis existing in in-calf cows, and this point may explain (in some cases at any rate) the reason why a cow having conceived at the first service, takes the bull perhaps several times subsequently. Heifers are frequently affected, and where vaginitis is found to exist in a herd the heifers (if any) will usually be noticed to be the worst cases.

The bull seldom escapes infection, but it is rarely that any symptoms noticeable to the casual observer are present. We have, however, seen during the past season as many as six bulls showing marked swelling of the sheath and a slight discharge from the preputial opening (it is sometimes referred to as balanitis in the bull), but, as before stated, those acute symptoms are exceptional. Unfortunately, the disease in the bull does not prevent his attentions to the cows, but tends rather to increase his activity in that direction.

METHOD OF SPREAD.

Some cases appear to arise spontaneously, but it is most commonly spread by the bull. Having served an affected cow, and becoming himself infected, he is capable of transmitting it to every cow which he afterwards serves. It is also possible for a diseased cow standing in a bail to switch some infective discharge from her tail on to the hindquarter of her neighbour and so infect the latter. During treatment the tubing used in irrigating an affected cow must be disinfected before again using. The same applies to the hands and fingers of those making an examination.

TREATMENT.

Cure is not difficult if the cases are observed early. Much harm is done through the condition not being recognized and strong antiseptic douches being used, which only tend to aggravate the already inflamed state of the membrane. The first essential in treatment is to remove the bull (if running with the herd), and to separate affected from healthy cows. Cows under treatment must be kept from the bull for a period of at least six weeks, otherwise treatment is useless. Lime-washing and disinfection of the shed should be carried out. The vaginal passage of affected cows must be irrigated with mild antiseptic and astringent solutions; strong antiseptics do more harm than good. The following solutions are recommended:—

Boric (boracic) acid, in the strength of two teaspoonfuls to a pint of water.

Solution of ordinary salt in water (normal saline solution), made by dissolving one dram (teaspoonful) of ordinary salt in a pint of boiled water.

Permanganate of potash, using one teaspoonful of the crystals to the gallon.

Sulphocarbolate of zinc, in the strength of one teaspoonful in a quart of water.

All water used in making any of the solutions must be first boiled, and used at blood-heat when irrigating. A quart of solution is sufficient to douche one cow. A piece of rubber tubing about 18 in. long, to which a funnel is attached, is the best means of introducing the fluid. There is no necessity to forcibly flush the passage by the

use of a strong syringe. After insertion into an affected cow the tubing should be placed for a few seconds in boiling water before again using. For irrigating the bull's sheath an ordinary bulb enema syringe with vulcanite nozzle can be used.

We have obtained the best results from the use of sulphocarbolate of zinc. The quantity mentioned (one teaspoonful in a quart of water) should be used to wash out the vaginal passage once daily. This must be continued for a fortnight. At the end of this time it is advisable to change the solution, going on to the permanganate for a week, and finishing up by a week's use of the salt solution.

It is found in practice that this plan of varying the solution used is useful. Experience also shows that one month's treatment is usually necessary to cure the disease, and in bad cases even longer. However, with a little patience and intelligent care it will be found that vaginitis can be cleared out of the herd, whereas neglect in treatment may result in serious economic loss.

Importation of Nauru Phosphate.—A statement of the importation of Nauru and Ocean Island phosphate into New Zealand since the British Phosphate Commission took charge shows that there has been a progressive increase in the shipments received, and that last year the Dominion imported practically 16 per cent. of the output, which is the amount of its quota under the agreement.

Administration of Noxious Weeds Act.—At its last meeting the Board of Agriculture considered the question of County Councils taking a more active part in the administration of the Noxious Weeds Act, the Minister having expressed a wish to secure an expression of the Board's opinion thereon. A recommendation was framed on the lines of County Councils being enabled to administer the control of noxious weeds.

Economy in Afforestation.—The last annual report of the State Forest Service states that experiments in more direct methods of planting in the Rotorua region plantations were successfully performed during the year. It was found that the substitution of notch planting for pitting (adopted experimentally over several hundred acres) will result in the lowering of establishment costs by 15s. per acre (a direct saving of at least £6,000 per annum in the annual North Island planting programme). A comparison of results indicates that the trees have succeeded as well, if not better, by the notching method than by pitting. This system is commended to private tree-planters.

The Sir James Wilson Prize.—Regulations governing this benefit—derived from a fund subscribed by the Farmers' Union in commemoration of Sir James Wilson's long and valuable services to the farming community in New Zealand—have been framed by the University Senate as follows: (1.) There shall be a prize to be called the Sir James G. Wilson Prize, of the value of about £5, to be given annually to the candidate who obtains the highest marks in the subject of agriculture in the examination for the degree of Bachelor of Agriculture. (2.) The prize shall be open to all candidates who are taking the course for the degree of Bachelor of Agriculture. (3.) The prize shall consist of books or instruments that are likely to be of service to candidates for the degree of Bachelor of Agriculture, and the books or instruments shall be selected by the winner and approved by the Chancellor. (4.) Every student intending to present himself for examination for the prize shall, not later than the 1st day of August preceding the examination, signify to the Registrar his intention to become a candidate for the prize. (5.) The prize shall not be awarded more than once to the same candidate.

GERMINATION OF AGRICULTURAL SEEDS.

NEW ZEALAND OFFICIAL TESTS, 1921 AND 1922.

THE following table shows the average germinations of agricultural seeds tested at the Department's seed-testing station during the calendar years 1921 and 1922 respectively. The figures are compiled from the analyses of approximately 10,000 commercial samples in each period.

Seed.	1922.	1921.	Seed.	1922.	1921.
		Principal Seeds.			
	Per Cent.	Per Cent.		Per Cent.	Per Cent.
White clover	92·0	90·7	Prairie-grass	60·4	66·0
Alsike	91·3	88·0	Crested dogstail ..	89·7	85·6
Cow-grass	93·2	90·9	Cocksfoot	66·8	63·9
Crimson clover ..	93·6	93·0	Paspalum	32·6	25·4
Lucerne	90·4	84·0	Oats	94·6	93·1
Trefoil	77·6	74·5	Peas	93·6	90·2
Lotus major	85·4	83·2	Turnip	89·0	87·4
Lotus angustissimus ..	77·2	65·1	Swede	85·9	85·3
Perennial rye-grass ..	79·0	80·9	Rape	93·7	90·0
Italian rye-grass ..	83·2	82·3	Kale	86·2	79·0
Western Wolths rye-grass	84·1	82·7	Mangold	129·7	124·6
Timothy	91·1	84·0	Mustard	87·2	87·5
Brown-top	76·2	56·9	Carrot	73·2	66·8
Red-top	80·0	84·5	Perennial rye-grass by districts—		
Fiorin	85·1	86·0			
Chewings fescue ..	76·3	60·7	Southern	76·2	81·3
Meadow-fescue ..	69·0	71·2	Canterbury ..	86·0	82·3
Meadow-foxtail ..	50·5	28·7	Sandon	76·3	84·0
Danthonia	47·3	37·6	Poverty Bay ..	94·8	93·7
Poa pratensis	50·0	43·2	Hawke's Bay ..	93·1	92·8
		Less Common Seeds.			
Suckling clover ..	81	70	Hard fescue	..	6
Subterranean clover ..	72	70	Sheep's fescue ..	36	72
Bokhara clover ..	..	81	Sheep's burnet ..	45	60
Egyptian clover ..	..	45	Poa trivialis	76	45
Strawberry clover ..	85	80	Rye-corn	82	95
Berseem clover ..	96	96	Rib-grass	..	60
King Island melilot ..	63	57	Indian doob	..	20
Sand clover	61	72	Rhodes grass	..	20
Lotus corniculatus ..	58	71	Couch	..	2
Sainfoin	35	76	Linseed	94	91
Phalaris bulbosa ..	..	62	Johnson grass ..	60	..
Japanese millet ..	89	87	Chicory	..	54
Tall oat-grass ..	53	50	Chou moellier.. ..	..	90
Sudan grass	83	83	Kohlrabi	80	91
Sorghum	50	56	Maize	90	86
Sweet vernal	..	41	Tares	94	99
Yarrow	88	62	Partridge peas ..	..	99
Yorkshire fog ..	86	83	Buckwheat	..	99
Tall fescue	66	76			

—*Nelson R. Foy, Biological Laboratory, Wellington.*

SEASONAL NOTES.

THE FARM.

FIELD CROPS AND PASTURES.

CULTIVATION.

On the heavier soils which hold moisture, and on land which is not adequately drained, spring cultivation is often difficult and not to be recommended, particularly if the ground is at all inclined to puddle when worked. Late autumn or early winter ploughing is a means of securing a suitable early seed-bed on such types of land. Thorough cultivation is essential for successful cropping. Many failures in summer crops are due to neglect of early and careful preparation of the soil. All roots and forages benefit by the moisture received and conserved on fallowed land. In addition the manure bill is less, because less manure is needed on early- and well-prepared soil. If farmers are using slowly soluble fertilizers for cropping, well-prepared soil allows of their better distribution, and they become available to the crop more quickly; moreover, less manure is lost than is the case on roughly cultivated ground.

Land intended for late sowings of winter wheat should be further cultivated in May; and where spring sowing is to be done it is essential that the soil should be turned up and exposed to the winter weather. The action of frost is most beneficial, especially to heavy soil, both for the improvement of texture and to kill the larvæ of destructive insects. This operation, as already indicated, also conserves moisture, and therefore helps in districts having a low rainfall. In preparing the seed-bed for cereal crops at this time of the year it is not advisable to work the land down too fine; if very loose it may be rolled before sowing, but should not be rolled after, as any clods will afford shelter for the young plants. The field may be rolled in spring to get a level surface. The use of the cultivator in forming the seed-bed will give better results than the disk and harrow; the cultivator works the fine soil down and the clods to the surface, which is ideal at this season.

CEREAL CROPS.

May sees the beginning of the wheat-sowing season in the South Island. All cereal seeds should be pickled before sowing, preferably by the formalin method. The two common smuts are the loose smut of wheat (*Ustilago tritici*) and the stinking smut or bunt (*Tillitia tritici*). Loose smut on wheat is contained in the ovary of the seed, and therefore cannot be destroyed by treatment with formalin. Care should be taken to procure seed from a clean crop. Loose smut in the case of oats (*Ustilago avenae*) is effectively killed by the formalin process. Bunt has its spores exposed always on the hairy end of the grain and in the groove, and for this reason is easily destroyed if treated carefully with the ordinary formalin solution, 1 pint to 30 gallons.

It is particularly desirable that Velvet and Pearl wheats should be got in as soon as possible in Canterbury and North Otago. Though it is also advantageous to get the Tuscans and Hunters in early, they can be delayed if other work is pressing. Algerian and Dun oats can be sown in May, and perhaps afford the best green feed of any varieties under Canterbury conditions. Gartons may also be fed off in the winter in certain localities, but they do not stool so well, and where the soil is of a light friable nature stock are likely to pull the plants out.

Having regard to the prevalence of Californian thistle, it is good practice generally to get oats sown in the autumn in the North Island as well as the South, as the crop will then ripen before there is any danger of the thistle-seeds maturing. On the other hand, spring-sown oats, which do not ripen for a month or six weeks later, are frequently badly infested with mature thistle-seed, and this is doubtless one of the principal means by which the pest is spread.

May is also a good month in which to sow catch-crops, such as barley, for early sheep-feeding. Black Skinless or Cape are suitable varieties of barley.

PREPARATION FOR MANGOLDS.

The mangold is a crop which should receive more attention from farmers who can give the necessary time to its cultivation. It provides valuable feed, particularly for dairy stock, pigs, and poultry. In a good crop the yield of roots is high, and it is not subject to the risks caused by insect pests and fungoid diseases which make turnip-growing so uncertain in many parts of the country. For dairy-farmers it has the advantage of not tainting the milk; moreover (when properly cured), it provides feed which is nutritious, easily digested, and readily assimilated by stock. Those who intend growing mangolds for next season should select a suitable area without delay and make early preparations. About one acre for every twenty cows should be sufficient. Select the cleanest field on the farm, with, if possible, a soil consisting of a deep friable loam or clay, though good crops of the Globe or Tankard varieties may be grown on light soils. If pasture land is to be broken up it should be skim-ploughed without delay, so as to fallow it during the winter. Though normally the mangold gets through dry spells very well it is safer and better practice to prepare for the crop early.

LUCERNE.

If autumn cultivation has not already been done, and a fairly dry spell of weather is experienced, lucerne stands should have any roughage cleared off with cattle, and then be scarified to loosen the surface of the land and check weeds before winter. If the ground is wet, however, it is usually better to forgo this cultivation. The winter months are the period when lucerne is resting, and under no circumstances should it be heavily grazed during that time. A few weaner cattle or pigs will not do it very much harm, but the better practice is to let it stand through the winter with a little rough growth. More lucerne-fields are perhaps ruined by heavy winter grazing than from all other means put together. It should be remembered that lucerne is grown primarily to provide heavy cuttings for hay and green feed in summer, and if denied a rest during the natural dormant period it does not start the spring properly rejuvenated, but is apt to give way to vigorous weeds and grasses.

TOP-DRESSING OF PASTURES.

Now is the time to decide what top-dressing is to be done this season. One of the secrets of success is to apply the fertilizer before the pasture shows much weakness. By this means the better grasses are preserved, the life of the pasture lengthened, and its feeding-value greatly improved. At one time it was thought that a heavy dressing at fairly long intervals gave the best results, but recent investigations go to show that for the average land the best results are obtained from more frequent applications. Basic slag may be applied at any time from May to August, but the months of June and July are generally preferable; 3 cwt. per acre is a suitable average dressing. Basic superphosphate or mixtures of super and Nauru phosphate are often best applied in July or the early part of August. Where it is intended to apply lime followed by super, the lime should be put on in May or June and the super early in August; 4 cwt. to 5 cwt. of carbonate of lime followed by 2 cwt. of super is recommended for average conditions. If it is desired to use Nauru phosphate alone it should be applied as early as possible.

Pastures should be well harrowed after top-dressing, and it is advisable to keep stock off for a week or two or until there has been a good fall of rain.

WINTERING OF DAIRY COWS.

The ordinary pastures will soon be slackening off in growth, and those farmers who made provision for winter forage crops or temporary pastures can extend the milking-period by feeding these. Most herds in the factory-dairying districts, however, will be dried off during May. Next season's returns will depend in no small degree on the treatment the cows receive during the subsequent two or three months. May to August should be recognized as a most important period for the cow, during which she should get the best of treatment. During this period (in the ordinary course) she not only has to mature a big calf, but also to recoup her general strength after a strenuous season and build up for the following one. If this is not properly accomplished she may readily fail to put up a good performance during the next season. It is easy to keep a cow going when she is in good condition, but once she gets down it is difficult to get her up again.

CALF-PADDOCKS.

Where small paddocks are provided they should be broken up and regrassed, if possible. Failing this they may be eaten bare with big cattle, then top-dressed with 10 cwt. of burnt lime per acre, to be followed in August with 2 cwt. of superphosphate per acre.

—*Agricultural Instruction Service.*

THE ORCHARD.

RECORDING THE SEASON'S EXPERIENCE.

THE best teacher is experience, and a fruitgrower will be wise (the busy harvest period being about closed) if he sits down and makes a careful note in the orchard log of the conclusions the experience of the season now passing has impressed upon him. It is best done now before the impression fades and while there is the possibility of some little leisure. For instance, in some of our larger fruitgrowing centres the season has been remarkable for the unusual amount of black-spot on the pip-fruits. What is more remarkable still, there are large areas of Cleopatra and Delicious apples—varieties specially susceptible to this disfiguring fungus—that are remarkably clean, while in the same orchard often Dunns and Jonathans—that are commonly immune—are badly affected. Why is this? Have these well-known characteristics been suddenly reversed? For the last two or three years there has been a tendency to defer the all-important early sprays. To apply them in early spring instead of in the depth of winter was an advantage that has been amply proved. Of late years fruitgrowers have been tempted to defer the application to the "green-tip" stage, and now they are inclined to make the application later still—in the "cluster-bud" stage. The inclination may be a good one, but experience has shown it to be very difficult to follow, especially on the larger areas. When deferred to the last moment in this way it only takes a brief spell of wind or rain or a pump breakdown to miss the important strong dormant spray altogether, and black-spot fungus activity then commences before preventive measures can be adopted. This happened in many instances this past season. Such recommendations, excellent as they may be, can only be carried out with confidence in the case of orchards that are abundantly equipped with spray-pumps and manual assistance. Otherwise it is not safe to defer the commencement of the first pip-fruit spray much later than early September, completing it before the fungus activity commences.

The wet spring and early summer made many growers reluctant to thin the rather heavy crop of apples that set, lest "dropping" should follow later. Dropping did not take place to any extent, and as a result four, five, and sometimes more fruits developed on a spur. This led to broken branches, a quantity of "fallings," forced off as maturity approached, and a big percentage of blemish on the remaining fruit owing to the impossibility of effectively spraying the tight clusters. The result was a 60-per-cent. (or less) "Fancy" grade in the crop. Experience surely has taught a lesson here.

In some stone-fruit sections during the months of January and February, when the weather was moist and hot, brown-rot was very prevalent in fallen fruit and on the trees. The fruitgrower was inclined to take consolation in the opinion that "it was the same in every orchard." But such was not the case; in some such areas this fungus was hard to find, and a good crop of stone-fruit was marketed. Brown-rot must be treated as a most infectious thing and given no chances.

These points and many more now demand the careful cogitation of the commercial fruitgrower, and that will not be effectual unless the conclusions for amended treatment are recorded in the log-book for use the following season.

FENCES, DRAINAGE, ETC.

The present is the best time for repairing the orchard fences and gates, trimming hedges, and cleaning out ditches and drains. It may seem like a counsel of perfection, but there is great comfort and saving of time in the fact that the fences are sufficiently secure to keep the hares out and the pigs in, and everything in its place. Again, drainage is only a name if the outlets are not

kept clear. Flood-waters should not be allowed to stand on orchard areas; one or two plough-furrows in the right place will go a long way to keeping the surface dry. A load or two of shingle in some of the more frequented gateways, and by the tank-stand where the spray-pump is filled, will not be amiss; it will save time and horse-harness in the busy season.

FRUIT IN STORE.

Fruit in store requires very close attention for the first month or so of storage. If the store is of the closed kind it should be ventilated freely at night and during the colder days, in order to dispose of excessive humidity and gases given off by the fruit. —*W. C. Hyde, Orchard Instructor, Nelson.*

CITRUS FRUITS.

In many citrus-groves a scarcity of autumn blossoming is very noticeable, particularly so in those which suffered from the frosts of last winter. When the blossom-petals have fallen from this blossoming an application of bordeaux (summer strength) should be given for the control of fungoid diseases. If scale insects are troublesome an application of red oil, at the rate of 1 part of oil to 40 of water, may be applied with beneficial effect when the trees are in the autumn growth.

Those growers contemplating the laying-down of new areas in citrus-trees during the coming season should now put the work of preparation in hand. The soil at this period is usually in excellent condition for the work. It is advisable that those requiring new trees should place their orders early, and have a careful selection of the best-grown trees on the right stocks only supplied to them.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

WINTER MANAGEMENT.

In anticipation of cold winter weather it is well to remember that if fowls are to produce a good return in egg-yield everything must be in their favour. This is not to imply that they should be coddled in warm, ill-ventilated quarters. They should be intelligently handled, especially as regards being protected from extremes of weather. A necessary provision is that the house should be roomy, with an open or partly open front as a means of admitting sunshine and fresh air, those great essentials to the well-being of the domesticated fowl. Of course, it must be draught-proof—there must be no cracks in the sides or back walls—or colds, roup, and other troubles may be expected. With such a house the birds can be fed inside during wet weather, and fed early in the evening, so that they will not be moping about with wet plumage waiting for their evening meal to be thrown down in a muddy yard.

All whole-grain food should be fed in deep litter as a means of inducing the birds to exercise as much as possible. There should always be odd grains of food in the litter, in order to keep the birds busy scratching for it. Every endeavour should be made to discourage the birds from resting on their perches by day, as this is apt to cause an overfat condition—a state which does not tend towards promoting heavy egg-production. This does not mean that the ration should be reduced in order to check a production of surplus fat. On the contrary, it means liberal feeding, but by a method which ensures that the birds are made to work to secure at least the greater part of their food. In the long nights of the winter months the birds have ample time to rest without doing so during the day. The life of the laying hen should be a busy one, and only in this condition will she prove to be really profitable.

In dealing with colds (which young birds especially are liable to take at this period of the year), the best advice is to look for the cause and remove it at once. If any birds become affected a simple method of checking the trouble is to place sufficient Condy's crystals in the drinking-water to give it a pink colour. The most common causes of colds are exposure to cold and wind, and ill-ventilated or draughty houses, while damp, dirty, overcrowded quarters are

often responsible. The symptoms are sneezing, eyes watering, nostrils closed, breathing deep, and offensive breath, while generally a bird thus affected also has an unthrifty appearance.

EGG PRODUCTION AND SUPPLY.

The fact that fresh eggs were being retailed in Wellington just before Christmas at 1s. 2d. a dozen, and gradually increased in price to 3s. a dozen by the middle of March, has caused considerable comment by the consuming public, and many are asking themselves if this great difference in price over such a short period is justified, and whether the extreme fluctuation in prices was based on the law of supply and demand or on manipulation of the market. Whatever the answer, the fact remains that the great variation in price during the period mentioned was far too great to be of much real benefit to either the producer or the consumer.

What is required is a more uniform price throughout the year as an inducement to keep the public eating eggs. This can only be brought about by poultrymen breeding more of their pullets to produce autumn eggs, or by a proper system of co-operation among producers for the purpose of cool-storing some of the summer surplus in shell for table use during the less productive seasons. It is only when poultrymen realize the necessity of making the best use of the refrigerator (as is done by the dairy-farmer) as a means of holding any summer surplus for use during the scarce season that consumption will materially increase and the market become stabilized. True, much has been done in this direction by placing in the freezer egg-pulp for winter use by confectioners and other large consumers of eggs; but this in itself is insufficient if the desired reforms are to be brought about. The table-egg trade must be considered as well. By adopting this course the winter prices would be reduced, but the summer prices would be increased. Such an increase in the price of the abundant summer eggs would be a great factor in making the business the profitable undertaking it should be for those engaged in it, and also in inducing people to take up poultry-keeping.

Much is being said in regard to the importance of establishing an export trade in eggs, but it is questionable if any market in the world offers better possibilities at the present time than the local trade, if the latter is catered for in a more intelligent manner. By all means let the industry test the oversea market, chiefly for the reason of ascertaining whether there exists a profitable outlet for any future surplus of supply that may be brought about. The marketing of not only the egg product but the table bird as well is the most vexed problem facing the poultry producer to-day. The problem will never be solved under the present general system of disposal. What is wanted is a sounder system of organization and loyalty among producers than exists to-day, as a means of bringing about the disposal of poultry under co-operative effort.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

LOCAL CONDITIONS IN RELATION TO MANAGEMENT.

As this *Journal* has a Dominion-wide circulation it is necessary that these notes shall as far as possible have a Dominion-wide application. Both climate and flora, however, vary considerably throughout New Zealand, and it is advisable to take this into consideration and vary general instructions to meet local conditions. Every beekeeper should carefully study his own locality both in regard to climate and flora. A knowledge of local conditions applied to the management of the apiary will frequently make all the difference between success and failure. The effect of flora and climate on the question of winter stores may be taken as an example. Most beekeepers throughout the Dominion are dependent on clover, hawkweed, and capeweed for their crop of honey, and it is necessary for them when preparing their bees for winter to leave sufficient honey in the hives to last the bees until this flora is again secreting nectar. From 30 lb. to 40 lb. is recommended. This appears to the novice to be a large quantity. That it is not too much is substantiated by records that have been kept by Mr. John Irving, of South Canterbury. For some years Mr. Irving has kept a colony of bees of

average strength on a scale, and kept a record of its gains and losses in weight. His records make interesting reading. It is sufficient for our purpose to quote the loss in weight of his scale hive during the months when the bees are gathering practically nothing from the fields and are dependent on their stores for sustenance—say, from 1st March to 1st December. The following is Mr. Irving's record for this period for the years named as published in the *Otago Witness* of 17th March last: 1915, loss in weight, 46 lb.; 1919, 34 lb.; 1920, 29 lb.; 1921, 45 lb.; 1922, 41 lb.

This is a fair indication of what the average colony would consume during that period, and of the weight of honey it is necessary for most beekeepers to leave in the hive. This does not apply, however, to all parts of the Dominion. In a district where there are a large number of commercial orchards, or an abundance of willows or native bush, such quantity of honey in the brood-chamber may prove a hindrance to the bees in the early spring. The queen would be cramped for room in which to deposit her eggs. In districts favoured with the flora mentioned beekeepers are frequently able to extract from 30 lb. to 60 lb. per colony of surplus honey during October. Obviously the proximity of large orchards or native bush calls for a system of management distinctly different to the plan adopted by beekeepers in open country, hence the necessity for every beekeeper to make himself acquainted with the peculiarities of the climate and flora of his own district. No clearly defined boundaries can be here named, and a system of management laid down for the district within such boundaries. A surplus is often extracted within ten miles of another district where the bees are starving. Clover sometimes fails almost entirely to yield nectar on account of a low temperature, while beekeepers surrounded by a wealth of thistle bloom may get a good crop of honey.

It will be obvious that if local conditions affect to such an extent the question of winter stores and the surplus gathered it will affect the management of the apiary generally. In the vicinity of commercial orchards or native bush the bees will probably require supers in September, but in open country these will not be required until November. In some fruitgrowing districts it is possible to raise queens in September, and many beekeepers are losing by not availing themselves of the special advantage their district offers them in this regard. If bees are worth keeping they are worth keeping well. There are comparatively few districts where bees cannot gather a crop of surplus honey, but it is necessary for the apiarist to intelligently co-operate with the bees and provide them with the necessary equipment at the right time. If, however, the would-be apiarist has any thought of commencing on a commercial basis it is advisable for him to obtain information of a reliable nature in regard to the probable average quantity and quality of the honey obtained in the district. While large quantites of honey are secured in the vicinity of the native bush it is often dark in colour and possessing an indifferent flavour. Such honey does not command a payable price.

—*H. W. Gilling, Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

In most places arrangements for the winter and spring supplies of cabbages, savoys, brussels sprouts, cauliflowers, and broccoli will have been completed some time back. In the middle districts planting should be finished by the end of January; a month earlier in colder districts; and extend to February in the warmer districts. In the latter—which are not entirely confined to the North—the cabbage-moth is a serious pest because it is active later in the season. There are, however, advantages that to some extent compensate for this difficulty. Broccolis, which supply the bulk of the so-called winter and spring cauliflowers, and are indispensable in cold districts, may well be omitted in warm places. Broccolis require a long period of growth, and must be planted during summer, when the moth is active. Cauliflowers come to heads in a much shorter time, and where sharp frosts are not experienced can take the place of broccolis. Experimental work has shown that early varieties sown on 1st April come into use from the third week in September, and large varities sown at the same time are ready a month later. Large varieties sown on 1st May were first cut on

30th November, so that the two sowings gave heads covering the same period as do broccolis, with the advantage of occupying the ground scarcely half the time, and that at a time when the moth is practically absent. So long as the soil is dry, shallow cultivation should be frequent. If the plants are not making satisfactory growth a little nitrate of soda will help them. This may be applied by scratching in a bare half-teaspoonful round each plant, or by dissolving 1 oz. in 4 gallons of water and giving each plant sufficient to reach its roots.

Winter rhubarb: Except in the coldest districts the evergreen varieties can be used the whole year round. It is, however, as a winter crop that they are valuable, and to secure a heavy winter crop very little produce should be taken in the summer months, the stalks being left to die down on the stools. As the stools are always growing, manuring at intervals is necessary to maintain strong growth. There appears to be no doubt but that stable manure is the best fertilizer for rhubarb, and it is considered to be practically impossible to overmanure it with this substance. This does not mean that unlimited quantities are either necessary or advisable, but that it pays to give a very liberal dressing. Fowl-manure in fairly heavy dressings has also proved to give good results where the soil is not of a clayey nature. Cow or pig manure should not be used, except on very light or sandy soil, as these manures make heavy land cold and soggy. When artificial fertilizers have to be used the case is different; comparatively small amounts given at more frequent intervals are safest and best. It is not well to always use the same fertilizer. Blood-and-bone at the rate of 4 oz. per square yard might be alternated with superphosphate 2 oz., bonedust 1 oz., and sulphate of potash and sulphate of ammonia each ¾ oz. Nitrate of soda, 1 oz. per square yard, may be used in addition to any other fertilizer or manure. It will pay to give this salt about three times a year at the present time, in spring, and about midsummer. Manuring or fertilizing should be attended to now before winter really commences.

Asparagus: The tops should be cut down as soon as they are practically dead, and before the berries fall; if the berries fall in any number they cause trouble, young plants coming up as weeds. The tops should be cut a little below the surface of the soil; if the stubs project above the surface not only are they a great nuisance when cleaning the bed, but they become hollow and form a congenial shelter for slugs, woodlice, and other pests. If the soil is weedy it should be cleaned by the means most appropriate in the circumstances. Nothing else need be done at the present time.

Spinach: Where spinach is grown for home use only the leaves are taken. The larger the leaves are the heavier will be the crop, and the better the quality. To secure large leaves the plants should be thinned to from 8 in. to 10 in. apart. For marketing, the whole plant is drawn for tying in bundles, and in this case thinning as just described is not to be done. Potash and nitrogen are both necessary for spinach and should not be omitted. Sulphate of potash, 1 oz. per square yard, should be added to any other fertilizers or manure given when the soil is being prepared, and nitrate of soda in like amount applied to the surface soil after the plants are well up.

Seakale: Although seakale might be out of place in an ordinary farm-garden, no station or homestead garden should be without it. Seakale, if well grown, forms quite the prettiest dish of vegetables, and can be had at any date desired during the winter months. Where a plantation is established the leaves should at the present time be dead or dying off. These should be cleared away (not dug in) and the soil turned over. No manuring is required, but a surface dressing to repel insects should be given. Salt is frequently used, but personally I prefer nitrate of soda, and give at least 4 oz. per square yard. This salt, at the amount stated, will kill small weeds and soft-bodied insects, and acts as a powerful fertilizer, causing strong leaf-growth the following season, with proportionately strong crowns for forcing the next winter, resulting in large heads; and the larger these are the better the quality and appearance. To force the heads the clumps are covered with a box with no bottom, and with a loose lid which is laid on top. The whole is then covered with fermenting manure, a depth of about 12 in. to the box from each side and the top being sufficient. Forcing takes about fourteen days, so that the seakale can be got ready for any date it may be wanted. A good deal of seakale is forced beneath benches in greenhouses, but as only heated houses are of service for the purpose the practice has only a limited application in this country.

—*W. H. Taylor, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COW WITH HARD QUARTER.

W. H. PREBBLE, Murchison :—

I should be obliged to you for information concerning the following: We have a second calver that has one quarter hard, and she does not give her milk as she should from this quarter; it only comes out in a dribble. The other quarters are all right.

The Live-stock Division :—

The hardness of the quarter is due to thickening of the gland-tissue, and is probably brought about by a prior case of mastitis. The latter may be due to faulty drying off after the last milking-period or to some accident to the udder. For example, the cow may have injured the udder when jumping over a log. We would advise the following treatment: After milking, apply hot foments to the part, afterwards thoroughly massaging the quarter and then rubbing in oleate of mercury in quantity about the size of a walnut.

LUPINS AND SOIL-INOCULATION.

P. FURSE, Hikuai :—

Will you kindly inform me if white lupin is successful as regards inoculation of soil—lucerne to follow; the time to sow—if April would be too late; the time required for rotting; and if white lupin is preferable to blue?

The Agricultural Instruction Service :—

A crop of lupins will not inoculate the soil for lucerne. You are advised to obtain some soil from an established lucerne-field. April would not be too late for sowing lupins in the Hikuai district, and the white lupin is the most suitable for your light soil. The green material would take about six weeks to rot.

FERTILIZERS FOR TOMATOES.

W. PHILLIPS, Petane :—

Would you kindly inform me as to the amount per acre of sulphate of potash and blood-and-bone to use in the culture of tomatoes, the plants being, say, 3 ft. between rows and 2 ft. between plants?

The Horticulture Division :—

The amount required naturally depends to some extent on the quality of the soil, what manuring it has had before, and what crops (if any) have been grown. There are cases where the soil is in very little need of manure for tomatoes, but presuming that it is required, then 12 cwt. of blood-and-bone per acre would be a fair dressing, this amount allowing a trifle less than 3 oz. per plant. Of sulphate of potash 2 cwt. per acre is sufficient.

PIG-WATTLE SEEDS FOR POULTRY.

H. W. SALTER, Lower Hutt :—

I am enclosing seeds supposed to be of the pig-wattle. I have heard that these are good for fowls, and should be glad to know if this is so. How should they be fed to the fowls?

The Chief Poultry Instructor :—

We have not had any direct experience in regard to feeding poultry with these seeds, but are given to understand that if fed sparingly they will not have an injurious effect on the birds. Judging, however, by the offensive smell they give off when chewed it is likely they would not tend towards giving the eggs a desirable flavour. For the latter reason alone it is recommended that they be but sparingly included in the ration of laying birds.

ERADICATION OF "WANDERING JEW" IN GARDEN.

C. I. MONRO, Palmerston North :—

I have about my place here a large quantity of the plant commonly known as "Wandering Jew," or "Creeping Jenny." Last autumn my vegetable-garden was trenched, and we buried this plant in the soil, expecting it to rot and give a fine supply of humus. However, on turning the soil over again in the spring we found that instead of rotting it had remained quite fresh and green, and during the summer it showed through the surface everywhere. Any information as to eradication will be appreciated.

The Horticulture Division :—

In referring to "Wandering Jew" or "Creeping Jenny" you mention two different plants. The former is *Tradescantia procumbens*. The latter is *Lysimachia nummularia*, which bears yellow flowers and has round leaves. The shape of the leaves has caused the name moneywort to be applied to the family. The species *nummularia* is known as herb-twopence and as Creeping Jenny. Doubtless it is the *Tradescantia* you are troubled with. Every joint of the fleshy branches will make roots if near enough to the air, but it has practically no other means of increasing, and the whole of it would have rotted away had it been buried deeper in the soil. The trenching should have been deep enough to prevent disturbing the weed when preparing the soil for crops. It will now be necessary to persevere with hoeing and cultivation as though it were couch-grass, or trench the soil again to a proper depth. A dressing of quicklime, 1 ton per acre, would hasten the decay of the buried matter.

ERADICATING SORREL.

"HIGH COUNTRY," Moawhango :—

I have just cut a heavy crop of oats off a paddock, and notice a lot of sorrel growing. Would you advise skim-ploughing and leaving it fallow for the winter, or would it be advisable to put lime on, and how much (cartage £2 5s. per ton from railway)? The elevation is 2,900 ft.

The Agricultural Instruction Service :—

You should plough the land about 4 in. deep and leave fallow over the winter, giving occasional harrowings in order to bring the sorrel to the surface, when the frost will kill it. It would greatly help the paddock if you could apply 5 cwt. of burnt lime per acre. This should be put on the ploughed surface, and may be applied any time during the winter.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 7th April: *Peas*—Demand is limited and buyers are holding back. Tasmanian, on spot, selling slowly at 85s. 6d. per quarter. New Zealand spot values 76s. to 80s. Japanese plentiful at 29s. 6d. per cwt. Maple: New Zealand February–March shipments offered at 71s. per quarter; afloat, sellers 72s. 6d., buyers 70s. Tasmanian March–April shipments offered at 82s. 6d., buyers 80s.; spot values 110s. to 115s. *Beans*—Fair supplies of English still obtainable. New Zealand nominal values 50s. to 52s. per quarter.

WEATHER RECORDS.

MARCH, 1923.

The following general summary and rainfall statistics are supplied to the *Journal* from the Dominion Meteorological Office:—

The early part of the month was generally fine, and anticyclonic conditions continued in the north until the 14th, when an extensive westerly low-pressure area which had previously established itself in the south spread its influences farther north, with squally and changeable conditions and scattered rainfall. The weather, though fair on the whole, continued very changeable for the rest of the month, and the last day of March was stormy in many parts of the Dominion. The lowest reading of the barometer—28·95 in.—was recorded at the Bluff on the 16th, and the highest—30·37 in.—at Wellington on the 5th. The southernmost districts and west coast had most rain. The rainfall was also over the mean in Nelson and Marlborough, but elsewhere the reports to hand are mostly well below the average for the month, being in some places on the east coast of the South Island as low as 65 per cent. under the mean; and in the North Island, at Masterton, 80 per cent., and at Maraekakaho Station, near Hastings, 82 per cent. deficient.

—*D. C. Bates, Director, Dominion Meteorological Office.*

RAINFALL FOR MARCH, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
		North Island.		
	Inches.		Inches.	Inches.
Kaitaia	4·74	4	4·00	3·58
Russell	2·68	4	1·92	3·42
Auckland	1·76	8	0·70	3·01
Hamilton	2·38	14	0·98	3·74
Kawhia	2·86	13	1·90	3·12
New Plymouth	4·29	13	1·89	3·46
Inglewood	6·76	14	2·70	7·14
Whangamomona	5·50	14	2·19	5·46
Tairua, Thames	3·08	5	1·44	6·73
Tauranga	2·82	9	1·38	4·00
Maraehako Station, Opotiki ..	2·44	4	1·28	3·90
Gisborne	1·10	5	0·69	4·60
Taupo	1·97	6	1·00	3·53
Maraekakaho Station, Hastings ..	0·59	5	0·38	3·35
Taihape	1·52	12	0·84	2·69
Masterton	0·64	10	0·23	3·23
Patea	3·25	12	1·46	3·60
Wanganui	2·49	7	0·92	2·60
Foxton	2·07	8	0·76	1·99
Wellington	2·00	8	1·12	3·23
		South Island.		
Westport	8·82	16	1·85	5·80
Greymouth	7·18	18	0·85	9·12
Hokitika	9·20	23	1·80	9·65
Arthur's Pass	..	..	..	5·84
Okuru, Westland	8·88	16	2·94	15·48
Collingwood	6·83	13	1·55	4·19
Nelson	3·24	9	1·28	2·93
Spring Creek, Blenheim.. ..	3·31	6	1·76	1·81
Tophouse	8·04	12	1·70	3·44
Hanmer Springs	3·50	6	1·22	2·84

RAINFALL FOR MARCH, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Waiau	1·59	5	0·75	1·60
Gore Bay	0·75	5	0·30	2·14
Christchurch	0·41	6	0·15	2·11
Timaru	0·98	7	0·56	2·45
Lambrook Station, Fairlie ..	2·08	5	0·86	2·58
Benmore Station, Omarama ..	1·68	7	1·22	2.64
Oamaru	..	..	..	1·77
Queenstown	2·54	10	0·65	2.63
Clyde..	..	..	..	1·50
Dunedin	3·46	16	..	2·92
Gore	..	..	..	3·23
Invercargill	7·62	19	1·58	3·66

Correction: The February rainfall at Napier (Park Island) was 1·39 in. on six days, not 2·78 in. on seven days as given in last month's issue.

WINTER FARM SCHOOLS, 1923.

THE Department has arranged courses of instruction for farmers in the various districts as follows:—

Auckland District: At Ruakura Farm of Instruction, Hamilton, 11th to 16th June. Applications for enrolment to be made to the Farm Manager.

Taranaki: At Stratford, 7th to 12th May. Enrolment with the Fields Instructor, Moumahaki Experimental Farm, Waverley.

Wellington: At Central Development Farm, Weraroa, 30th April to 5th May. Enrolment with the Farm Manager.

Canterbury: At Ashburton, 14th to 19th May. Enrolment with the Instructor in Agriculture, Department of Agriculture, Christchurch.

Otago and Southland: At Dunedin, 29th May to 4th June. Enrolment with the Instructor in Agriculture, Department of Agriculture, Dunedin.

Details of the respective schools (programme, accommodation, &c.) have been published in the local Press in each case, but any further information desired may be obtained from the departmental officers specified above. Early enrolment is advisable.

FORTHCOMING WINTER SHOWS.

Waikato Winter Show Association: Hamilton, 29th May to 4th June.
Otago A. and P. Society: Dunedin, 5th to 8th June.
Taranaki Metropolitan Agricultural Society: New Plymouth, 6th to 9th June.
Manawatu A. and P. Association: Palmerston North, 19th to 22nd June.
South Taranaki Winter Show Company: Hawera, 3rd to 7th July.
Auckland A. and P. Association: Auckland, 17th to 21st July.

Another 1,000 lb. Butterfat Record.—The mature Friesian cow Hilda Minto de Kol, owned and tested by Mr. C. H. Steadman, Kamo, this month completed a 365-days lactation period under C.O.R. test with a production of 27,773·8 lb. milk and 1,046·31 lb. butterfat. She is due to calve about 30th May, which is well within the time stipulated for a first-class certificate.

REVIEW.

"THE DISEASES OF FARM ANIMALS IN NEW ZEALAND."

UNDER this title a noteworthy addition to what may be termed the utility literature of New Zealand has been made by Lt.-Col. H. A. Reid, F.R.C.V.S., D.V.H., &c., head of the Veterinary Laboratory of the Department of Agriculture, at Wallaceville. Col. Reid needs no introduction to readers of the *Journal*, having been for many years a contributor to this publication — the present issue, in fact, containing a good example of his informative and helpful articles. In the book now under notice—a volume of 587 pages, with thirty illustrations—the author has correlated a wide experience in field and laboratory with the aspect of practical stock-management. The keynote of the work in this respect may perhaps be best indicated by quoting one of its opening passages where (dealing with the general care and nursing of sick animals) the author remarks,—

"The health which the majority of animals in New Zealand enjoy can be attributed largely to the open-air existence which they habitually lead, and their relative freedom from the drawbacks attaching to insanitary and unhygenic surroundings. Nevertheless, even under the best management, disease is liable to occur. Its early detection and the application of rational methods of treatment assures the best means of combating such trouble when it arises. A correct appreciation of the habits and attitudes which animals in health assume is indispensable when we come to consider them under contrary conditions. There being no subjective symptoms, the diagnosis of animal-disease is in the main a process of deduction from observation. The faculty of correct observation demands constant practice."

This is common-sense; and Col. Reid, in his careful and comprehensive descriptions of the causes, symptoms, and treatment of the various diseases dealt with in the book, furnishes a fund of information which will prove of great value to all interested in the care and management of live-stock.

The book is divided into three main parts, dealing with microbic diseases, parasitic diseases, and general diseases respectively. There are also useful general sections on such branches of the main subject as diet, methods of administering medicines, disinfection and disinfectants, &c. Extracts from the Stock Act and regulations thereunder printed as appendices, together with a general index, complete the volume.

Written as it is for New Zealand conditions, the book will assuredly find a place on many a farmhouse shelf. While it is a wise course for stockowners to avail themselves of the services of a reliable veterinary surgeon when possible, there are many districts in the Dominion which have no private practitioner within reach, and in these cases "The Diseases of Farm Animals in New Zealand" will be of special assistance and utility.

The publishers, Messrs. Whitcombe and Tombs, Wellington, have done their part with merit. The book is well printed on good paper and strongly bound in cloth boards. It is issued at the price of 25s.

Gisborne Land District.—A land district bearing this name and having its principal office at Gisborne has been constituted as from 1st April. The new district has been formed partly out of the Auckland and partly out of the Hawke's Bay Land Districts, the boundaries of which are amended accordingly. Roughly it comprises the counties of Cook, Waikohu, Waiapu, Opotiki, and part of Wairoa. Its coastal boundary-points are the mouth of the Maraetotara River (Bay of Plenty) and Ngakau-o-te-Paritu (Hawke's Bay). Details are given in the *Gazette* of 15th March, 1923.

The New Zealand
Journal of Agriculture.

VOL. XXVI.—No. 5.

WELLINGTON, 21ST MAY, 1923.

THE GRASSLANDS OF NEW ZEALAND.

PRINCIPLES OF PASTURE-ESTABLISHMENT.

(Continued.)

E. BRUCE LEVY, Biological Laboratory, Wellington.

GRASS-SEED MIXTURES FOR VARIOUS SOILS AND CONDITIONS.

PERHAPS one of the greatest difficulties that confronts the farmer in the establishment of pasture is what to sow. In the preceding articles of this series the writer has not given very many types of mixtures for the respective soils, and those given represent what one might consider fair average mixtures for the types of country dealt with. Climate and farm-management, however, have a very decisive bearing on just what species should constitute the mixture sown. These vary from district to district, and thus a species which may be ideal for one set of climatic condition and for one style of farm-management may not suit another in the least, although the soil conditions may be almost identical. Nevertheless, when the subject of grasslands is studied undoubtedly one finds that under average normal conditions of farming, stocking, &c., there is a general reassortment of pasture-species, so that each type of soil becomes populated finally by more or less the same species of grasses and clovers, or by

the same class of weed-growth if those pasture plants more or less suited to that soil are not sown or are otherwise prevented from migrating on to such area.

In grassland research undoubtedly one of the first things necessary is accurately to determine just which species of grasses and clovers will persist on the various classes of soils under normal stocking-conditions. The second line of study is to learn exactly the developmental stages through which the pasture may go from the sowing until such time as the soil is populated with those species that are permanent there. The third line is to gauge the effect that the various types of farm-management have on the developmental stages that occur in the life-cycle of the pasture. Any really comprehensive system for devising grassland mixtures must be based on information derived from these three lines of study. In New Zealand our knowledge is not mature and conclusive on any one of these, but a sufficient amount of information has been gleaned to set down a more or less tentative scheme as a basis for grassland mixtures.

In the following Table 1 the leading types of soils are arranged consecutively according to their nature. Those species of grasses and clovers that will remain permanent under average normal stocking-conditions, on the various types of soils, are set down under the heading " Permanent Elements." These really represent those species that can persist on the various soils in virtue of the fact that they are naturally suited to or are in harmony with the existing environmental conditions. In the second column are set out those species which will last on the various types of soils for some two or three years, but which at the end of that period " run out," their place (theoretically) becoming occupied by certain of those species in the " Permanent Elements " column. These short-rotation elements are really successional species, and it is they which will form certain at least of the developmental stages in the pasture-cycle. Under certain conditions of farm-management the life of these species may be prolonged or shortened according to treatment meted out, and undoubtedly in almost every case the objective should be to prolong the life of such species as far as possible by careful manipulation of stock and by top-dressing with artificial manures, for it will be observed that in a great number of soil-types the final permanent species which that soil is capable by itself of supporting are inferior in quality, palatability, and carrying-capacity. In the third column are set out the purely temporary elements of the sowings—those that will last for one or at most two years. These will come away early in the grassland cycle, and will constitute the first developmental stages in the life of the pasture. The stage is purely temporary, and care must be exercised that this stage does not overdevelop, else the resulting stages may be seriously affected.

It will be noted that in the table the same species often figures in more than one column. This serves to indicate, in the case of the permanent elements, that those species are more inclined to " go out " at the end of the time specified at the top of the column than to persist as really permanent elements. It means, in fact, that the latter are permanent only under good careful management. In the case of the temporary elements persisting, in certain cases this is due largely

to understocking, or to the soil conditions being favourable to re-establishment from seed that has fallen the previous summer. Again, among the permanent elements, it will be noted, are many species, and it is not expected that in any one pasture-sowing all those given in the list will be included in the one pasture-mixture. Thus in sowing down high-class swamp-lands cocksfoot, perennial rye-grass, timothy, red clover, and white clover may be all that the farmei requires as permanent elements; or the objective on that same soil may be a meadow-foxtail and Poa trivialis pasture; and, again, under exceptional conditions a paspalum or a prairie-grass pasture.

According to requirements, then, those permanent elements that the farmer wishes his pasture to consist of are selected out of the permanent elements list for any one respective soil-type, and these having been selected other elements from the short-rotation column and from the temporary column are chosen, and a mixture thus compiled.

In the last column for each respective soil-type are given the names of some common plants which are likely to prove aggressive in the established grassland. Such plants, on the whole, must be looked upon as undesirable constituents, and farm-management must be directed towards the prevention of their entry, else they will come in and crowd out altogether, or at least take the place of, certain of the desirable grassland constituen+s. It will be noted that in quite a number of instances certain grasses and clovers are necessary and desirable on certain types of soil, but are ranked undesirable when present in certain other types of soil. Tall fescue, for example, is an unmitigated weed on high-class swamp-land, whereas it may fill a very important place on certain poor grassland soils. Brown-top, also, is a very valuable grass for certain poorer types of short-rotational grassland soils, yet it must be ranked as undesirable on the major portion of the first-class short-rotational soils that so frequently become invaded by this grass, and which really should be carrying a pasture of the cocksfoot, crested dogstail, white clover type.

TABLE I, INDICATING DURATION OF THE VARIOUS PASTURE-GRASSES AND CLOVERS ON THE DIFFERENT GRASSLAND SOILS.

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
	Good Average First-class Ploughable Country.		
Cocksfoot Timothy Perennial rye-grass Crested dogstail Meadow-fescue Prairie-grass Paspalum Red clover White clover Subterranean clover.	Red clover Perennial rye-grass Alsike Prairie-grass.	Italian rye-grass Western Wolths rye-grass Crimson clover Alsike.	Yorkshire fog Field-daisy Ox-eye daisy Rushes Blackberry Californian thistle Ragwort Creeping butter-cup Plantain Self-heal.

TABLE I—*continued.*

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
High-class Swamp-lands and Alluvial River Deposits.			
Cocksfoot Perennial rye-grass Timothy Meadow-foxtail Poa trivialis Paspalum Prairie-grass Italian rye-grass Phalaris bulbosa Red clover Lotus major Alsike White clover.	Red clover Perennial rye-grass Italian rye-grass Western Wolths rye-grass Alsike Prairie-grass.	Italian rye-grass Western Wolths rye-grass Crimson clover.	Tall fescue Poa aquatica Yorkshire fog Rushes Pennyroyal Field-daisy Reed canary-grass Blackberry Creeping butter-cup Goat's-rue.
Wet Undrained Swamps.			
Lotus major Yorkshire fog Red-top Timothy Glyceria fluitans.	Timothy Perennial rye-grass Alsike.	Perennial rye-grass Western Wolths rye-grass Italian rye-grass Alsike.	Rushes Sedges Tall fescue Poa aquatica Reed canary-grass Raupo.
Raw Peat Swamp-lands, unconsolidated.			
Lotus major Paspalum Brown-top Red-top Yorkshire fog.	Perennial rye-grass Yorkshire fog Red clover.	Italian rye-grass Western Wolths rye-grass Perennial rye-grass Red clover White clover.	Manuka Fern Sorrel Blackberry Rushes.
Consolidated Peat-swamp.			
Cocksfoot Crested dogstail Paspalum Timothy Poa pratensis Lotus major White clover Subterranean clover.	Perennial rye-grass Red clover Timothy.	Italian rye-grass Western Wolths rye-grass Red clover Alsike Crimson clover.	Yorkshire fog Brown top Red-top Danthonia Sorrel Pennyroyal Blackberry Californian thistle.
First-class Short-rotational Grassland Soils; the better Second-class Soils in general.			
Cocksfoot Crested dogstail Timothy Paspalum Tall oat-grass Meadow-fescue White clover Subterranean clover Lotus major.	Perennial rye-grass Red clover Timothy Meadow-fescue.	Italian rye-grass Western Wolths rye-grass Alsike Crimson clover.	Yorkshire fog Brown-top Catsear Rib-grass Plantain Goose-grass Ragwort Californian thistle St. John's wort.

TABLE 1—*continued.*

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
Poor Short-rotational Grassland Soils, Shingly River-beds, Poor Clays, &c.			
Cocksfoot Crested dogstail Brown-top Chewings fescue Poa pratensis Danthonia Paspalum Yorkshire fog Tall fescue Lotus hispidus Lotus major Suckling-clover White clover.	Perennial rye-grass Red clover White clover Cocksfoot Crested dogstail.	Italian rye-grass Western Wolths rye-grass Red clover.	Sweet vernal Hair-grass Goose-grass Rib-grass Catsear English hair-grass Tarweed Twitch Yarrow St. John's wort Gorse Broom Manuka.
Soil of a Saline Nature; Reclaimed Tidal Flats, &c.			
Peren'l rye-grass Cocksfoot Timothy Crested dogstail Meadow-foxtail Poa trivialis Paspalum Strawberry clover White clover Alsike. Lotus major	Perennial rye-grass Italian rye-grass Red clover Alsike.	Italian rye-grass Western Wolths rye-grass.	Tall fescue Shore plantain Rushes Pennyroyal Large-leaved plantain.
Moving Sands of the Dune Complex.			
Marram-grass Spinifex Pingao. (Established by planting.)	Yellow lupin King Island melilot Bokhara clover Yorkshire fog Brown-top. (Sown in established marram, &c., or on fixed sands behind dunes.)		
Fixed Sands following on previous Type.			
Paspalum Ratstail New Zealand rice-grass Danthonia Poa pratensis Yorkshire fog Suckling-clover Lotus hispidus Clustered clover Striated clover Burr clovers.	Perennial rye-grass Red clover King Island melilot Yorkshire fog.	Italian rye-grass Red clover.	Evening primrose Tauhinu.

TABLE I—*continued.*

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
		Old Stabilized Sand Areas.	
Crested dogstail Poa pratensis Paspalum Cocksfoot Ratstail New Zealand rice-grass Danthonia Hair-grass Yarrow English trefoil Annual clovers.	Perennial rye-grass Red clover.	Italian rye-grass Red clover (Rape or Japanese millet as cover-crops).	Wiwi Mariscus Tauhinu Sheep's burr Piripiri (hutiwai) Hair-grass English hair-grass Catsear.
		Volcanic Soils and Light Sandy Loams.	
Cocksfoot Crested dogstail Peren'l rye-grass Paspalum Poa pratensis Prairie-grass Red clover White clover Subterranean clover.	Perennial rye-grass Red clover Prairie-grass	Italian rye-grass Western Wolths rye-grass Alsike.	Sweetbriar Inkweed Sorrel Apple of Sodom Cretian mullein.
		Limestone Soils.	
Cocksfoot Crested dogstail Perennial rye-grass Poa pratensis Poa trivialis Meadow-foxtail Paspalum Strawberry clover Subterranean clover Lucerne English trefoil Lotus major White clover.	Perennial rye-grass Red clover Alsike.	Italian rye-grass Western Wolths rye-grass Alsike.	Ratstail Tall fescue Pennyroyal Horehound Plantain Catsear Blackberry Californian thistle.
		First-class Forest-lands; Tawa, Rimu, White-pine, Big Rata, Big Kamahi, Puriri, Tall Bracken-fern, &c.	
Cocksfoot Crested dogstail Poa pratensis Timothy Perennial rye-grass Meadow-foxtail Poa trivialis Paspalum White clover Lotus major Yarrow.	Perennial rye-grass Red clover Timothy Alsike.	Italian rye-grass Western Wolths rye-grass Alsike.	Water-fern Hard-fern Bracken-fern Rushes Blackberry Plantain Creeping butter-cup Tutu Piripiri (hutiwai) Pennyroyal Tall fescue.

TABLE I—*continued.*

Permanent Elements.	Short-rotation Elements, 2–3 Years.	Temporary Elements, 1–2 Years.	Some Undesirable Permanent Elements.
Second-class Steep Forest-lands; Totara, Kamahi, Upland Kauri, Beech, Coastal Forest, and Bracken-fern 2 ft. to 3 ft. high.			
Cocksfoot Crested dogstail Poa pratensis Danthonia Brown-top Chewings fescue Paspalum Yorkshire fog Lotus spp. White clover Yarrow Subterranean clover.	Cocksfoot Crested dogstail Perennial rye-grass Red clover.	Italian rye-grass Alsike.	Bracken-fern Hard-fern Manuka Piripiri (hutiwai) Rushes Catsear St. John's wort Californian thistle Foxglove Tutu Sweetbriar Tutsan Gorse.
Third-class Stunted Forest and Scrub Lands.			
Chewings fescue Danthonia Brown-top Poa pratensis Paspalum Yorkshire fog Lotus hispidus Suckling-clover White clover Yarrow.	Cocksfoot Crested dogstail Perennial rye-grass Red clover White clover.	Italian rye-grass Red clover Perennial rye-grass.	Manuka Mingimingi Pomaderris Tauhinu Piripiri (hutiwai) Stunted fern Catsear Sweetbriar Gorse.

From the foregoing table one may judge fairly well the species that should be selected for the pasture-mixture, but no clue is there given as to the quantity of seed of each to use. The following mixtures have been drawn up and are put forward as a guide to the quantities of each species that should be included in the mixture. They are grouped under the respective soils, and consist of permanent, rotation, and temporary-pasture mixtures.

Soil-type 1: Good Average First-class Ploughable Country.

PERMANENT PASTURES.

(1.) *Average General Mixture.*

	lb.
Perennial rye-grass	15
Cocksfoot	10
Crested dogstail	3
Timothy	3
Italian rye-grass	4
Red clover	3
White clover	2
Total per acre	40

(2) *Adopting Use of Meadow-fescue.*

	lb.
Perennial rye-grass	15
Cocksfoot	6
Meadow-fescue	6
Crested dogstail	3
Timothy	3
Italian rye-grass	4
Red clover	3
White clover	2
Total per acre	42

PERMANENT PASTURES—*continued.*

(3.) *For Establishment of Paspalum.*

	lb.
Perennial rye-grass	15
Cocksfoot	6
Italian rye-grass	8
Paspalum	6
Red clover	3
White clover	2
Subterranean clover	1
Total per acre	41

(4.) *For Establishment of Prairie-grass.*

	lb.
Perennial rye-grass	8
Prairie-grass	60
Italian rye-grass	6
Red clover	4
Total per acre	78

SHORT-ROTATION PASTURES (2–4 YEARS' DURATION).

(1.) *General Grazing Type.*

	lb.
Perennial rye-grass	20
Italian rye-grass	8
Red clover	6
Total per acre	34

(2.) *Grazing and Hay Type.*

	lb.
Perennial rye-grass	15
Cocksfoot	6
Timothy	4
Italian rye-grass	8
Red clover	4
Alsike	2
Total per acre	39

A fed-off cereal or rape cover-crop may be included in these short-rotation pastures. The Italian rye-grass may then be left out.

TEMPORARY PASTURES (1–2 YEARS' DURATION).

(1.)

	lb.
Italian rye-grass	12
Western Wolths rye-grass	12
Red clover	6
Total per acre	30

(2.)

	lb
Italian rye-grass	25
Red clover	6
Total per acre	31

If Western Wolths is substituted for Italian rye-grass in No. 2 more rapidly produced feed is secured. For late autumn sowings 2 lb. of alsike should be added to the mixtures.

Soil-type 2: High-class Swamp and Alluvial River Deposits.

PERMANENT PASTURES.

(1.)

	lb.
Perennial rye-grass	12
Cocksfoot	10
Timothy	4
Italian rye-grass	4
Meadow-foxtail	4
Poa trivialis	2
Red clover	2
Alsike	2
White clover	2
Total per acre	42

(2.)

	lb.
Perennial rye-grass	15
Cocksfoot	10
Timothy	6
Italian rye-grass	4
Red clover	4
Alsike	2
White clover	1
Lotus major	1
Total per acre	43

Prairie-grass and paspalum pastures may be established by using mixtures 4 and 3 respectively given under soil-type 1. Paspalum is not particularly recommended on these specially rich types of soil, as more palatable grasses may be successfully used.

SHORT-ROTATION PASTURES (2–4 YEARS' DURATION).

(1.)	lb.	(2.)	lb.
Perennial rye-grass	8	Perennial rye-grass	10
Italian rye-grass	15	Italian rye-grass	20
Timothy	8	Red clover	4
Red clover	6	Alsike	2
White clover	2	White clover	2
Total per acre	39	Total per acre	38

A fed-off cereal or rape cover-crop may be used in these short-rotation pasture-mixtures similarly to those of soil-type 1.

TEMPORARY PASTURES (1–2 YEARS' DURATION).

(1.)	lb.	(2.)	lb.
Western Wolths rye-grass	25	Italian rye-grass	12
Red clover	6	Western Wolths rye-grass	12
		Red clover	4
Total per acre	31	Alsike	2
		Total per acre	30.

Crimson clover, 2 lb., may be added to these and the red clover correspondingly reduced.

Soil-type 3: Peat Swamp-lands.

SUB-TYPE A: RAW UNCONSOLIDATED AND UNPLOUGHABLE.

Breaking-in Mixtures, Surface-sown.

(1.)	lb.	(2.)	lb.
Yorkshire fog	8	Yorkshire fog	6
Perennial rye-grass	6	Paspalum	3
Italian rye-grass	3	Brown-top	1
Red-top	1	Perennial rye-grass	6
Brown-top	1	Italian rye-grass	3
Lotus major	2	Lotus major	2
Total per acre	21	Total per acre	21

Seed spread by means of hay fed out on to these areas is more successful than the mere surface-sowing of seed.

SUB-TYPE B: RAW UNCONSOLIDATED PEAT SWAMP-LANDS, PLOUGHED.

First phase: Breaking-in consolidating pasture-mixtures are as follows:—

(1.)	lb.	(2.)	lb.
Yorkshire fog	8	Yorkshire fog	6
Lotus major	2	Paspalum	3
Perennial rye-grass	8	Brown-top	1
Italian rye-grass	6	Perennial rye-grass	8
		Italian rye-grass	6
Total per acre	24	Lotus major	2
		Total per acre	26

Second phase: The area is reploughed and sown by one of the following mixtures:—

(1.)	lb.
Italian rye-grass	12
Western Wolths rye-grass	12
Red clover	6
White clover	2
Total per acre	32

(2.)	lb.
Western Wolths rye-grass	25
Red clover	6
White clover	2
Total per acre	33

Third phase: In the second year of the above temporary sowing introduce permanent elements, either by surface-sowing of seed or by feeding-out of hay containing ripe seed of the desired permanent elements. Cover seed with the harrows. Top-dressing seed-mixtures are as follows:—

(1.)	lb.
Cocksfoot	10
Crested dogstail	3
Timothy	2
Perennial rye-grass	10
White clover	2
Total per acre	27

(2.)	lb.
Cocksfoot	10
Crested dogstail	3
Paspalum	4
Perennial rye-grass	10
White clover	2
Subterannean clover	1
Total per acre	30

SUB-TYPE C: MATURELY CONSOLIDATED PEAT SWAMP-LANDS.

PERMANENT PASTURES.

(1.)	lb.
Cocksfoot	15
Crested dogstail	3
Timothy	3
Perennial rye-grass	10
Italian rye-grass	6
Red clover	3
White clover	2
Lotus major	2
Total per acre	44

(2.)	lb.
Cocksfoot	8
Crested dogstail	2
Perennial rye-grass	10
Italian rye-grass	6
Paspalum	3
Red clover	2
White clover	1
Lotus major	1
Subterranean clover	1
Total per acre	34

SHORT-ROTATION PASTURES, 2–3 YEARS.

	lb.
Perennial rye-grass	25
Red clover	6
White clover	2
Total per acre	33

TEMPORARY PASTURES, 1–2 YEARS.

(1.)	lb.
Italian rye-grass	25
Red clover	6
Total per acre	31

(2.)	lb.
Western Wolths rye-grass	25
Red clover	6
Total per acre	31

Soil-type 4: Wet Low-lying Undrained Swamps.

This type is capable of being grazed only in the summer and of being sown in the autumn following a burning-off of nigger-head,

Mariscus, and other plants which usually populate these areas. The following mixture is suggested :—

	lb.
Yorkshire fog	8
Perennial rye-grass	8
Brown-top	1
Timothy	4
Lotus major	2
Total per acre	23

Glyceria fluitans (sweet floating-grass) should be introduced if possible, but seed is at present not available commercially. The plant is very common in New Zealand, and is to be found in almost all waterlogged areas where the water is on the move.

Soil-type 5: First-class Short-rotational Grassland Soils—Good Second-class Soils in general.

PERMANENT PASTURES.

(1.)	lb.
Cocksfoot	15
Crested dogstail	4
Perennial rye-grass	10
Timothy	2
Red clover	3
White clover	2
Total per acre	36

(2.)	lb.
Cocksfoot	10
Crested dogstail	4
Meadow-fescue	6
Perennial rye-grass	10
Italian rye-grass	4
Red clover	3
White clover	2
Total per acre	39

(3.)	lb.
Cocksfoot	8
Crested dogstail	2
Perennial rye-grass	10
Italian rye-grass	4
Paspalum	4
Red clover	3
White clover	2
Subterranean clover	1
Total per acre	34

SHORT-ROTATION PASTURES.

(1.) *2–3 Years' Duration.*	lb.
Perennial rye-grass	25
Red clover	6
Total per acre	31

(2.) *3–4 Years' Duration.*	lb.
Perennial rye-grass	20
Cocksfoot	8
Timothy	2
Red clover	4
White clover	2
Total per acre	36

TEMPORARY PASTURES, 1–2 YEARS.

Italian rye-grass, 25 lb.; red clover, 6 lb.: total per acre, 31 lb.

Soil-type 6: Second-class Short-rotational Grassland Soils, Gravels, Poor Clays, &c.

PERMANENT PASTURES.

(1.) *For Slightly Wet Situations.*	lb.
Cocksfoot	6
Crested dogstail	2
Waipu brown-top	2
Poa pratensis	1
Perennial rye-grass	10
Italian rye-grass	6
Red clover	2
White clover	1
Total per acre	30

(2.) *For Conditions Similar to No. 1.*	lb.
Perennial rye-grass	15
Italian rye-grass	6
Waipu brown-top	2
Yorkshire fog	2
Poa pratensis	2
Crested dogstail	2
Red clover	2
White clover	1
Total per acre	32

PERMANENT PASTURES—*continued.*

(3.) *For Drier Conditions than No. 2.*

	lb.
Perennial rye-grass	15
Italian rye-grass	4
Chewings fescue	4
Danthonia pilosa	2
Tall fescue	2
Red clover	2
White clover	1
Total per acre	30

(4.) *For Establishment of Paspalum.*

	lb.
Perennial rye-grass	15
Italian rye-grass	4
Waipu brown-top	2
Paspalum	3
Crested dogstail	2
Lotus major	1
Red clover	2
White clover	1
Subterranean clover	1
Total per acre	31

(5.) *For Establishment of Chewings Fescue for Seed.*

	lb.
Perennial rye-grass	20
Italian rye-grass	6
Chewings fescue	4
Red clover	2
White clover	1
Total per acre	33

Mixtures for short-rotation pastures, 2–3 years, and temporary pastures, 1–2 years' duration, are as for soil-type 5.

Soil-type 7: Saline Soils, Reclaimed Tidal Flats, &c.

PERMANENT PASTURES.

(1.)

	lb.
Perennial rye-grass	15
Italian rye-grass	4
Timothy	3
Meadow-foxtail	3
Poa trivialis	1
Cocksfoot	8
Red clover	3
Strawberry-clover	1
White clover	1
Lotus major	½
Total per acre	39½

(2.)

	lb.
Perennial rye-grass	15
Italian rye-grass	4
Timothy	4
Cocksfoot	10
Red clover	3
Lotus major	1
Strawberry-clover	1
White clover	1
Total per acre	39

(3.) *For Establishment of Paspalum.*

	lb.
Perennial rye-grass	15
Italian rye-grass	4
Timothy	2
Cocksfoot	6
Paspalum	3
Lotus major	1
Strawberry-clover	1
White clover	1
Subterranean clover	1
Total per acre	34

Mixtures for short-rotation pasture, 2–4 years, and temporary pastures are similar to those given for soil-type 1. Certain of these soils are admirably adapted for lucerne, and in certain instances the inclusion of 2 lb. of lucerne per acre in the grass-mixture is to be recommended.

Soil-type 8: Coastal Sand Areas.

SUB-TYPE A: MOVING AND UNCONSOLIDATED SANDS.

First phase: Plant roots of marram, Spinifex, or pingao.

Second phase: Sow yellow lupin (best sown in the pod), or plant ice-plant (in North Island only), on the areas stabilized by the marram, &c.

Third phase: Sow among lupin, &c., the following mixture:—

	lb.
Yorkshire fog	4
Perennial rye-grass	6
Poa pratensis	2
Waipu brown-top	1
Paspalum	4
King Island melilot	2
English trefoil	2
Lotus hispidus	2
Subterranean clover	1
Total per acre	24

SUB-TYPE B: STABILIZED SANDS.

PERMANENT PASTURES.

(1.) *For Undulating Portions.*

	lb.
Cocksfoot	12
Crested dogstail	3
Perennial rye-grass	10
Poa pratensis	2
Danthonia pilosa	2
Waipu brown-top	1
Red clover	2
White clover	2
English trefoil	2
Total per acre	36

(2.) *For Wetter Sand-plains.*

	lb.
Cocksfoot	15
Crested dogstail	3
Perennial rye-grass	10
Italian rye-grass	4
Timothy	3
Red clover	2
English trefoil	2
White clover	2
Total per acre	41

(3.) *For Establishment of Paspalum.*

	lb.
Perennial rye-grass	12
Italian rye-grass	4
Cocksfoot	8
Crested dogstail	2
Waipu brown-top	1
Paspalum	4
Red clover	2
White clover	2
Subterranean clover	1
Total per acre	36

These mixtures are best sown in rape-stubble in the autumn, or along with rape in the early spring. Mixtures for short-rotation, 2–3 years, and temporary pastures, 1-2 years' duration, are as for soil-type 5.

Soil-type 9: Volcanic Soils.

SUB-TYPE A: PLOUGHABLE SCORIA TYPE.

PERMANENT PASTURES.

(1.) *Damp and Low-lying.*

	lb.
Cocksfoot	10
Timothy	4
Perennial rye-grass	15
Poa trivialis	2
Meadow-foxtail	4
Red clover	3
White clover	2
Total per acre	40

(2.) *More Elevated and Sloping.*

	lb.
Cocksfoot	15
Crested dogstail	4
Timothy	2
Perennial rye-grass	10
Italian rye-grass	4
Red clover	3
White clover	2
Total per acre	40

(3.) *For Establishment of Paspalum.*

	lb.
Cocksfoot	8
Crested dogstail	3
Perennial rye-grass	12
Italian rye-grass	4
Paspalum	4
Red clover	2
White clover	1
Subterranean clover	1
Total per acre	35

SUB-TYPE B: PUMICE TYPE.

(1.) *Unconsolidated.*

	lb.
Italian rye-grass	10
Perennial rye-grass	10
Yorkshire fog	6
Waipu brown-top	2
Red clover	4
Lotus major	1
White clover	1
Lotus hispidus	1
Total per acre	35

(2.) *Consolidated.*

	lb.
Cocksfoot	15
Crested dogstail	4
Perennial rye-grass	10
Red clover	4
White clover	2
Lotus major	1
Total per acre	36

Soil-type 10: Limestone Soils.

SUB-TYPE A: PLOUGHABLE.

PERMANENT PASTURES.

(1.)	lb.	(2.)	lb.
Cocksfoot	12	Cocksfoot	8
Crested dogstail	3	Crested dogstail	3
Perennial rye-grass	10	Perennial rye-grass	12
Timothy	3	Italian rye-grass	4
Italian rye-grass	4	Paspalum	4
English trefoil	2	Red clover	2
Lucerne	2	English trefoil	2
Red clover	1	Lotus major	1
		Subterranean clover	1
Total per acre	39	White clover	1
		Total per acre	38

Mixtures for short-rotation pastures, 2–4 years, and temporary pastures, 1–2 years' duration, are as for soil-type 1.

SUB-TYPE B: STEEP AND UNPLOUGHABLE (PAPA SOILS).

(1.) *For Wetter Shady Slopes.*	lb.	(2.) *For Drier and Poorer Slopes.*	lb.	(3.) *For Establishment of Paspalum.*	lb.
Cocksfoot	10	Cocksfoot	10	Cocksfoot	10
Crested dogstail	3	Crested dogstail	3	Crested dogstail	3
Poa pratensis	1	Poa pratensis	2	Perennial rye-grass	10
Meadow-foxtail	2	Yorkshire fog	2	Paspalum	4
Poa trivialis	1	Waipu brown-top	1	Red clover	2
Perennial rye-grass	8	Perennial rye-grass	10	Lotus major	1
Italian rye-grass	4	Red clover	2	White clover	1
Red clover	2	White clover	1	Subterranean clover	1
Lotus major	1	English trefoil	1		
English trefoil	1			Total per acre	32
White clover	1	Total per acre	32		
Total per acre	34				

Soil-type 11: First-class Forest Lands.

SUB-TYPE A: LOWLAND, FLAT OR UNDULATING, OF THE TAWA, RIMU, WHITE-PINE, PUKATEA FOREST TYPE.

(1.)	lb.	(2.)	lb.
Cocksfoot	10	Cocksfoot	15
Crested dogstail	2	Crested dogstail	2
Timothy	4	Perennial rye-grass	8
Perennial rye-grass	10	Timothy	4
Meadow-foxtail	2	Italian rye-grass	4
Poa trivialis	1	Red clover	3
Italian rye-grass	4	Lotus major	1
Red clover	2	White clover	2
White clover	2		
Lotus major	1	Total per acre	39
Total per acre	38		

SUB-TYPE B: STEEP OR UNDULATING, OF THE BIG RATA, PURIRI, BIG KAMAHI, TAWA, TALL BRACKEN-FERN TYPE.

(1.)	lb.	(2.)	lb.
Cocksfoot	10	Cocksfoot	8
Crested dogstail	4	Crested dogstail	3
Poa pratensis	2	Timothy	2
Danthonia pilosa	2	Perennial rye-grass	10
Timothy	2	Italian rye-grass	4
Perennial rye-grass	8	Paspalum	4
Italian rye-grass	4	Red clover	2
Red clover	2	White clover	1
White clover	2	Lotus major	1
Lotus major	½		
Total per acre	36½	Total per acre	35

Soil-type 12: Second-class Forest Lands—Totara, Matai, Hinau, Rewarewa, Kamahi, Southern Beech, Upland Kauri; Bracken-fern, 2-3 ft. high, or Strong Manuka.

(1.)	lb.	(2.)	lb.	(3.)	lb.
Cocksfoot	8	Cocksfoot	8	Cocksfoot	8
Crested dogstail	3	Crested dogstail	3	Crested dogstail	3
Perennial rye-grass	8	Perennial rye-grass	8	Perennial rye-grass	8
Waipu brown-top	1	Chewings fescue	4	Paspalum	4
Yorkshire fog	2	Waipu brown-top	2	Lotus hispidus	1
Danthonia pilosa	2	Italian rye-grass	2	Italian rye-grass	2
Italian rye-grass	2	Lotus hispidus	1	White clover	1
Lotus hispidus	1	White clover	1	Lotus major	1
White clover	1	Lotus major	½		
Lotus major	½	Yarrow	¼	Total per acre	28
Yarrow	¼				
Total per acre	28¾	Total per acre	29¾		

Soil-type 13: Third-class Forest Lands—Stunted Forest and Scrub; Upland Dry-face Beech; Short Fern.

(1.) *For Dry Slopes.*	lb.	(2.) *For Damper Slopes.*	lb.	(3.) *For Establishment of Paspalum.*	lb.
Perennial rye-grass	8	Perennial rye-grass	8	Perennial rye-grass	10
Tall fescue	2	Crested dogstail	2	Waipu brown-top	2
Waipu brown-top	2	Waipu brown-top	2	Yorkshire fog	4
Chewings fescue	4	Yorkshire fog	8	Paspalum	4
Danthonia pilosa	2	Danthonia pilosa	2	White clover	1
Yorkshire fog	4	White clover	1	Suckling-clover	1
White clover	1	Suckling-clover	1		
Suckling-clover	1	Yarrow	1	Total per acre	22
Yarrow	1				
Total per acre	25	Total per acre	25		

In putting forward the foregoing set of mixtures the writer does not claim that these represent the final word in connection with grass-mixture formulas. They are based upon the developmental study of grasslands as they occur in New Zealand to-day. More efficient farm-management may show that certain of those stages of the pasture succession which the writer now looks upon as transient may be made more or less permanent. This in itself would be

sufficient to considerably modify the present formulas. Farm-management will to a very large extent finally govern the type of mixture sown, but under the present system of grass farming it seems much the wiser plan to include in the permanent-pasture mixtures those species of grasses and clovers that are able to adapt themselves naturally to the conditions as they now appear in grassland-management.

The quantity of seed recommended in mixtures here given is in general higher than is usually sown at the present time, and, while certain reduction might be made throughout, the writer is confident that the specified amount of seed sown will reflect very beneficially in the character of the resultant pasture. There is no doubt that farmers can rely on introducing certain permanent elements in a more or less indirect fashion, by the manipulation of their stock and by the manner in which the latter are fed. Thus many grasses may be transferred adhering to the wool of sheep, or carried from one paddock to another by means of their dung. It is common knowledge that on many soils white clover need not be sown, as it comes in naturally. This is true also of old pastures containing Lotus major, paspalum, Poa pratensis, or brown-top—these plants readily re-establishing themselves either from seed shed or by renewed growth of their underground stems or rootstocks that have not been killed out in the working of the land. A knowledge of just what vegetation will assert itself when the pasture is laid down will influence very largely the actual grass-mixture that is applied to that land. The farmer, therefore, by knowing what seed there is in the ground, or by a knowledge of certain indirect methods of introducing seed to the ground, may be able to save a certain amount on his mixtures, but it is a wise plan to err on the safe side and to make sure that those desirable species are safely introduced.

Farmers who are just starting on the land, if that land be ploughable, are recommended more to adopt (for some years at least) the temporary and rotational mixtures rather than the permanent ones. The former are in general cheaper to put down—an important consideration—and while adoption of the short-rotational pastures means more actual work the return is greater and more rapid. The permanent pasture really pertains to the well-established man who can afford to spend more and to wait longer for a return. In the latter case invested money brings its return: in the former case, where money is lacking, one has to spend less and rely more on hard work.

Mention may also be made of a point with regard to paspalum establishment and to the establishment of the clovers associated with it, particularly subterranean clover. To establish successfully, paspalum likes for preference a well-consolidated seed-bed, and certain farmers in the North are of the opinion that this seed should not be sown with the original sowing, but should be surface-sown later, in the second year, after consolidation of the surface has taken place through stocking. Again, on the better classes of soil subterranean clover is very likely to get away in the early spring and to cause injury to the grass sward by its smother. In such case paspalum, which is slow to establish, may also be smothered out. So far as this clover is concerned it would appear best to get the paspalum established and then to sow seed of subterranean clover on to the paspalum.

It should not be necessary to emphasize that this question of grassland seed-mixtures is a most important one. The selection of suitable grasses and clovers and their establishment really afford—under New Zealand conditions—a starting-point for the display and bringing to bear of rational, efficient farm-management. No matter how good a farmer may be or how excellent his management he is seriously handicapped if his paddocks are filled with inferior grasses and weeds.

The subject of the quality of the seed sown for pastures will be dealt with in the next article of this series.

MANURIAL EXPERIMENTS IN CANTERBURY.

SOME PROGRESS OBSERVATIONS.

F. E. WARD, Instructor in Agriculture, Christchurch.

OWING to the comparative lack of authentic information concerning various phases of manuring in Canterbury, special efforts have been made during the past season to procure data upon which some reliance can be placed. The work was commenced rather late; therefore the present experiments had to be confined to top-dressing of pasture and the manuring of turnips and mangolds. It is clearly understood that one season's work can in no way be taken as conclusive, but the results of the tests up to the time of writing so emphatically confirm previous experience that a brief progress report is justified. The tests are organized on a co-operative basis, the farmers chosen being men who are willing to continue the experiments for a number of years.

PASTURES.

Three top-dressing experiments were planned on different types of soil—namely, heavy loam in a damp situation, medium loam in a drier situation, and on typical light Plains country. The two first-mentioned tests were on pasture intended for hay, to be followed by a crop of red clover. The last-mentioned was conducted as a feeding-test only. In each of the first two trials the fertilizers used included superphosphate, basic super, super and lime, and Nauru raw rock phosphate. A mixture of potash and ammonium sulphate was applied across a portion of the plots in each case.

On the heavy damp loam it was difficult to discern any difference in the growth of hay, but on taking green weights the basic superphosphate plots gave the highest yields. The rock phosphate (in keeping with its slow-acting character) gave no appreciable increase, and the value of potash and nitrogen appeared to be of negligible value. The aftergrowth was even throughout, there being no apparent difference.

On the medium loam, in a drier locality, the results were very marked. The effects of superphosphate were most remarkable, both in the hay crop and in the subsequent growth of clover. Nauru rock again gave no increase, the same applying to the dressing of potash and nitrogen. If anything, potash had the effect of depressing the yield.

FIG. I. AFTERGROWTH ON HAYFIELD, PERRYMAN BROS.' FARM, TAI TAPU.

On left, 2 cwt. superphosphate per acre; on right, control (no manure). Photo taken in January last, five months after top-dressing. Pasture three years old.

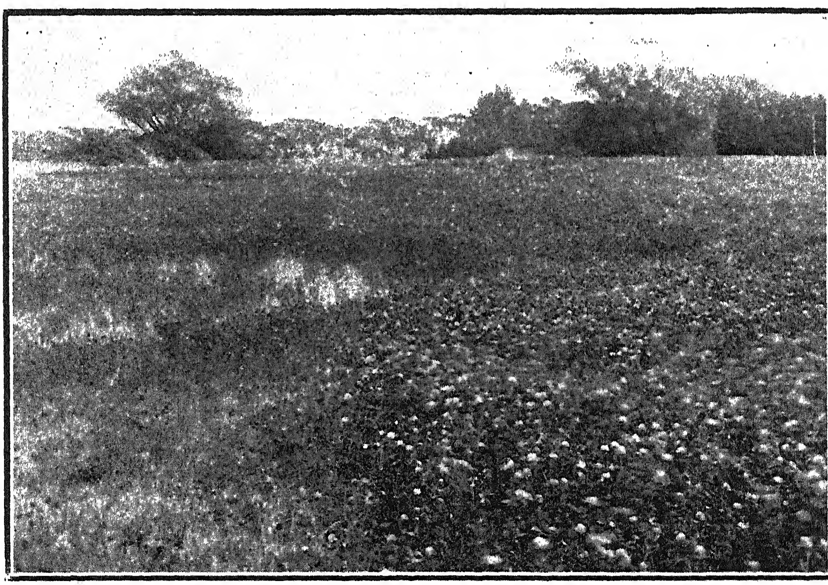


FIG. 2. ANOTHER VIEW IN THE SAME FIELD, SEVEN MONTHS AFTER TOP-DRESSING.

On left, control; on right, 2 cwt. superphosphate per acre. Photo taken in March.

FIG. 3. TURNIPS AT ASHBURTON EXPERIMENTAL FARM, SHOWING ADVERSE EFFECT OF SUPERPHOSPHATE SOWN IN CONTACT WITH THE SEED, ON LIGHT LAND.

On left, 2 cwt. superphosphate; on right, 1 cwt. superphosphate.

FIG. 4. MANGOLD TEST PLOT ON MR. J. PARLANE'S FARM, CASHMERE, SHOWING OUTSTANDING EFFECT OF SUPERPHOSPHATE ALONE.

The two middle rows received 2 cwt. superphosphate per acre. The first row to the left is the control; for other manures see text.

The grazing experiment was made as simple as possible in order to reduce the work entailed in weighing sheep on and off. The test was made with superphosphate against basic super and control. The area of each plot was 2 acres. Seventeen ewe hoggets were put on each plot on 11th December and removed on 10th March last. The fertilizers were applied on 8th September last. They therefore had not a really good chance, and these figures do not show an economical return for the expenditure to date. The results show in favour of 2 cwt. of superphosphate per acre, which gave a gain in weight of 94 lb. over the unmanured plot. Two hundredweight of basic super gave an increase of 9 lb. over control, while the 1 cwt. superphosphate plot and 1 cwt. basic super plot both gave a minus result.

Though the value of basic super containing rock phosphate and lime in localities having a high rainfall is appreciated, it appears that under Canterbury conditions the soluble superphosphate gives quicker and more economical results. The idea prevalent among farmers in Canterbury that the constant use of superphosphate results in increasing soil-acidity cannot be said to be well founded. The amount of free acid present in 1 cwt. of super is so small that it may well be disregarded. Soils of an acid nature can be improved by more thorough tillage and the periodical application of lime, followed by superphosphate supplied with the crop.

TURNIPS.

An extensive test is being conducted on turnips, using proprietary mixtures, superphosphate, and basic super in varying quantities, with a cross-application of potash and nitrogen on a part of the area. The soil in this case is of a light loamy nature with a low moisture-content. The most striking feature of these experiments has been that with either superphosphate or basic super, applied at the rate of 2 cwt. per acre in contact with the seed, germination was adversely affected. The same applied in the case of 1 cwt. of the same fertilizers, though to a lesser degree. This action was possibly due to the ground being rather dry at the time of sowing. In the case of the proprietary mixtures germination was all that could be desired and subsequent growth good. A cross-application of potash and ammonium sulphate has made no marked difference up to the present.

MANGOLDS.

An experiment carried out on mangolds has probably shown more clearly than any other the phosphate-requirements of certain Canterbury soils. This particular crop was grown in soil which some years ago grew good roots, but of recent years has given disappointing results. The fertilizers applied were as follows: (1) Complete mixture; (2) phosphate and potash; (3) phosphates and nitrogen; (4) potash and nitrogen; (5) control; (6) superphosphate alone; (7) potash alone; (8) nitrogen alone. The rows which received superphosphate alone have stood out right through, no other plot in any way approaching them. Fig. 4 clearly demonstrates the point, reading from left to right in the order given — double rows for each manuring and a single row for the control.

HERD-TESTING ASSOCIATIONS.

DOMINION LIST FOR SEASON 1922–23.

W. M. SINGLETON, Director of the Dairy Division.

RETURNS showing the number of cows being tested under the association system in New Zealand during the season 1922–23 are now practically complete. Since the publication of the estimated totals in the March *Journal* the aggregate has risen to 83,605 cows, of which 34,558 are in associations controlled by the Dairy Division and 49,047 in privately controlled associations. The following list gives particulars and shows how the movement is represented in various parts of the Dominion:—

Associations controlled by Dairy Division.

Name of Testing Association.	Principal Dairy Companies which Members supply.	Number of Cows.
Alton	Alton Co-operative Dairy Company, Ltd. ..	234
Aria	Aria Co-operative Dairy Company, Ltd. ..	653
Awatuna ..	Awatuna Co-operative Dairy Company, Ltd. ..	690
Bull's	Rangitikei Co-operative Dairy Company, Ltd. ..	145
Bunnythorpe ..	Glaxo Manufacturing Company (N.Z.), Ltd. ..	611
Cheltenham ..	Cheltenham Co-operative Dairy Company, Ltd.	1,311
Dunedin ..	Waitaki Dairy Company, Ltd.	94
Eltham ..	Eltham Co-operative Dairy Company, Ltd. ..	1,292
Hauraki Plains ..	Hauraki Plains Co-operative Dairy Company, Ltd.	319
Hawera ..	Hawera Co-operative Dairy Company, Ltd. ..	790
Heretaunga ..	Heretaunga Co-operative Dairy Company, Ltd.	231
Hikurangi ..	Hikurangi Co-operative Dairy Company, Ltd. ..	1,465
Hokianga ..	Hokianga Co-operative Dairy Company, Ltd. ..	1,456
Horsham Downs	Horsham Downs Co-operative Dairy Co., Ltd. ..	228
T. L. Joll ..	T. L. Joll Co-operative Dairy Company, Ltd. ..	2,500
Kaipara ..	Kaipara Co-operative Dairy Company, Ltd. ..	2,100
Kairanga ..	Kairanga, Whakaronga, and Newsbury Co-operative Dairy Companies, Ltd.	462
Kaitieke ..	Kaitieke Co-operative Dairy Company, Ltd. ..	2,903
Kaponga ..	Kaponga Co-operative Dairy Company, Ltd. ..	272
Kaupokonui ..	Kaupokonui Co-operative Dairy Company, Ltd.	1,971
Kennington ..	Kennington Co-operative Dairy Company, Ltd.	130
Kia Ora ..	Kia Ora Co-operative Dairy Company, Ltd. ..	1,061
Kuku	Kuku Co-operative Dairy Company, Ltd. ..	130
Levin	Levin Co-operative Dairy Company, Ltd. ..	657
Lowgarth ..	Lowgarth Co-operative Dairy Company, Ltd. ..	177
Maketawa ..	Maketawa Co-operative Dairy Company, Ltd. ..	250
Makowhai ..	Glen Oroua Co-operative Dairy Company, Ltd.	338
Mangahao ..	Mangahao Co-operative Dairy Company, Ltd. ..	241
Mangatoki ..	Mangatoki Co-operative Dairy Company, Ltd. ..	411
Maungatapere ..	Maungatapere Co-operative Dairy Company, Ltd.	506
Mells	Mells Co-operative Dairy Company, Ltd. ..	204
Melrose ..	Melrose Co-operative Dairy Company, Ltd. ..	486
Ngaere	Ngaere Co-operative Dairy Company, Ltd. ..	696
Normanby ..	Normanby Co-operative Dairy Company, Ltd. ..	69
North Canterbury	Canterbury Central, Cam, and Tai Tapu Co-operative Dairy Companies, Ltd.; Avon, Mid-Canterbury, and Kiwi Dairy Companies, Ltd.; and Sefton Mutual Dairy Produce Assn., Ltd.	786

Associations controlled by Dairy Division—continued.

Name of Testing Association.	Principal Dairy Companies which Members supply.	Number of Cows.
Okitu	Okitu Dairy Factory	162
Okoia	Okoia Co-operative Dairy Company, Ltd. ..	400
Omata	Omata Co-operative Dairy Company, Ltd. ..	162
Opotiki ..	Opotiki Co-operative Dairy Company, Ltd. ..	747
Ormondville ..	Ormondville and Norsewood Co-operative Dairy Companies, Ltd.	302
Owaka	Stirling, Fairfield, and Owaka Co-operative Dairy Companies, Ltd.; and Clutha and Waitaki Dairy Companies, Ltd.	305
Perger	Waitara Co-operative Dairy Company, Ltd. ..	13
Pihama.. ..	Pihama Co-operative Dairy Company, Ltd. ..	606
Piopio	Piopio Co-operative Dairy Company, Ltd. ..	1,066
Riverbank ..	Riverbank Co-operative Dairy Company, Ltd. ..	26
Riverdale ..	Riverdale Co-operative Dairy Company, Ltd. ..	513
Shannon ..	Shannon Co-operative Dairy Company, Ltd. ..	216
Tariki	Tariki Co-operative Dairy Company, Ltd. ..	295
Te Rehunga ..	Tamaki Co-operative Dairy Company, Ltd. ..	280
Tokomaru ..	Tokomaru Co-operative Dairy Company, Ltd. ..	421
Tolaga Bay ..	Tolaga Bay Co-operative Dairy Company, Ltd.	349
United	United Co-operative Dairy Company, Ltd. ..	118
Uruti	Uruti Co-operative Dairy Company, Ltd. ..	418
Wangaehu ..	Wangaehu Co-operative Dairy Company, Ltd. ..	403
Whangarei ..	Whangarei Co-operative Dairy Company, Ltd.	1,227
Westmere ..	Westmere Co-operative Dairy Company, Ltd. ..	266
Woodville ..	Woodville Co-operative Dairy Company, Ltd. ..	178
	Total for 57 associations	34,558

Associations privately controlled..

Ballance Valley ..	Ballance Valley Co-operative Dairy Company, Ltd.	22
Bell Block ..	Bell Block Co-operative Dairy Company, Ltd. ..	533
Carrington ..	Carrington Co-operative Dairy Company, Ltd. ..	55
Clevedon ..	N.Z. Co-operative Dairy Company, Ltd. ..	500
Dalefield ..	Dalefield Co-operative Dairy Company, Ltd. ..	102
Featherston ..	Featherston Co-operative Dairy Company, Ltd.	135
Frankton No. 1 ..	N.Z. Co-operative Dairy Company, Ltd. ..	1,200
Frankton No. 2 ..	N.Z. Co-operative Dairy Company, Ltd. ..	800
Glen Oroua ..	Glen Oroua Co-operative Dairy Company, Ltd.	120
Glyn	Glyn Co-operative Dairy Company, Ltd. ..	24
Herekino ..	Herekino Co-operative Dairy Company, Ltd. ..	24
Hopelands ..	Hopelands Co-operative Dairy Company, Ltd. ..	135
Horsham Downs	Horsham Downs Co-operative Dairy Co., Ltd...	24
Kaitaia ..	Kaitaia Co-operative Dairy Company, Ltd. ..	514
Kaituna ..	Kaituna Co-operative Dairy Company, Ltd. ..	428
Katikati ..	Katikati Co-operative Dairy Company, Ltd. ..	800
Kokatau ..	Kokatau Co-operative Dairy Company, Ltd. ..	35
Linkwater ..	Linkwater Co-operative Dairy Company, Ltd. ..	105
Little Akaloa ..	Little Akaloa Co-operative Dairy Company, Ltd	105
Maharahara ..	Maharahara Co-operative Dairy Company, Ltd.	80
Mangorei ..	Mangorei Co-operative Dairy Company, Ltd. ..	337
Marakopa ..	Marakopa Co-operative Dairy Company, Ltd. ..	60
Masterton ..	Masterton Co-operative Dairy Company, Ltd. ..	36
Matakana ..	Matakana Co-operative Dairy Company, Ltd. ..	50
Matahiwi ..	Matahiwi Dairy Factory, Ltd.	26
Matangi ..	Glaxo Manufacturing Company (N.Z.), Ltd. ..	200
Maungaturoto ..	Maungaturoto Co-operative Dairy Company, Ltd.	950
Mercury Bay ..	Mercury Bay Co-operative Dairy Company, Ltd.	265

Associations privately controlled—continued.

Name of Testing Association.	Principal Dairy Companies which Members supply.	Number of Cows.
Midhirst ..	Midhirst Co-operative Dairy Company, Ltd. ..	187
Ngaruawahia ..	N.Z. Co-operative Dairy Company, Ltd. ..	800
Ngatea	N.Z. Co-operative Dairy Company, Ltd. ..	1,700
Norfolk ..	Norfolk and Tatua Co-op. Dairy Companies, Ltd.	1,776
Norsewood ..	Norsewood Co-operative Dairy Company, Ltd.	80
Northern Wairoa	Northern Wairoa Co-operative Dairy Co., Ltd. ..	2,175
Okato	Okato Co-operative Dairy Company, Ltd. ..	390
Oroua Downs ..	Oroua Downs Co-operative Dairy Company, Ltd.	150
Oruru-Fairburn ..	Oruru-Fairburn Co-operative Dairy Co., Ltd. ..	828
Otago Central ..	Otago Central Co-operative Dairy Company, Ltd.	100
Otorohanga ..	N.Z. Co-operative Dairy Company, Ltd. ..	2,000
Paeroa	N.Z. Co-operative Dairy Company, Ltd. ..	1,700
Paraparaumu ..	Paraparaumu Co-operative Dairy Company, Ltd.	20
Parkvale ..	Parkvale Co-operative Dairy Company, Ltd. ..	168
Pembroke ..	Pembroke Co-operative Dairy Company, Ltd. ..	147
Port Albert ..	Port Albert Co-operative Dairy Company, Ltd.	355
Pukekohe ..	N.Z. Co-operative Dairy Company, Ltd. ..	2,000
Raglan	Raglan Co-operative Dairy Company, Ltd. ..	250
Rangitaiki Plains	Rangitaiki Plains Co-operative Dairy Co., Ltd.	275
Rapanui ..	Rapanui Co-operative Dairy Company, Ltd. ..	100
Rata	Rata Co-operative Dairy Company, Ltd. ..	2,177
Rongokokako ..	Rongokokako Co-operative Dairy Company, Ltd.	21
Rotorua ..	Rotorua Co-operative Dairy Company, Ltd. ..	150
Royal Oak ..	Royal Oak Co-operative Dairy Company, Ltd.	294
Stratford ..	Stratford Co-operative Dairy Company, Ltd. ..	530
Taikorea ..	Taikorea Co-operative Dairy Company, Ltd. ..	52
Taratahi ..	Taratahi Co-operative Dairy Company, Ltd. ..	300
Tataramoa ..	Tataramoa Co-operative Dairy Company, Ltd.	39
Tauranga ..	Tauranga Co-operative Dairy Company, Ltd. ..	800
Te Aroha West ..	Glaxo Manufacturing Company (N.Z.), Ltd. ..	700
Te Awamutu ..	Kakepuku Co-operative Dairy Company, Ltd. ..	1,300
Te Horo ..	Te Horo Co-operative Dairy Company, Ltd. ..	15
Te Poi	Sunny Park Co-operative Dairy Company, Ltd.	340
Te Puke ..	Bay of Plenty Co-operative Dairy Company, Ltd	1,450
Tikorangi ..	Tikorangi Co-operative Dairy Company, Ltd. ..	618
Tiratu	Tiratu Co-operative Dairy Company, Ltd. ..	40
Tuakau.. ..	N.Z. Co-operative Dairy Company, Ltd. ..	1,500
Waharoa ..	N.Z. Co-operative Dairy Company, Ltd. ..	2,500
Waiaruhe ..	Waiaruhe Co-operative Dairy Company, Ltd. ..	60
Waihou ..	N.Z. Co-operative Dairy Company, Ltd. ..	1,000
Waikato Farmers' Union	N.Z. Co-operative Dairy Company, Ltd., at Te Rapa, Te Kowhai, and Orini Factories, and others	7,500
Waikato Valley ..	Waikato Valley Dairy Company	150
Waimate ..	Waimate Co-operative Dairy Company, Ltd. ..	509
Waipu	Waipu Co-operative Dairy Company, Ltd. ..	48
Wairoa ..	Wairoa Co-operative Dairy Company, Ltd. ..	100
Waitanguru ..	Waitanguru Co-operative Dairy Company, Ltd.	197
Waitemata ..	Waitemata Co-operative Dairy Company, Ltd.	151
Waitoa ..	N.Z. Co-operative Dairy Company, Ltd. ..	700
Waiuku ..	N.Z. Co-operative Dairy Company, Ltd. ..	1,600
Wanganui Fresh Food	Wanganui Fresh Food and Ice Company, Ltd. ..	250
Whangaroa ..	Whangaroa Co-operative Dairy Company, Ltd.	500
Whenuakura ..	Whenuakura Co-operative Dairy Company, Ltd.	500
	Total for 80 associations	49,047

A marked feature of these lists is the small number of cows under association test in the South Island, the total being 2,134. It is recognized, of course, that much of the South Island is devoted more particularly to branches of farming other than dairying; nevertheless, the number quoted cannot be accepted as a satisfactory proportion of its dairy cows. It is hoped that South Island dairy-farmers will increasingly realize the value of testing, and that next season will evidence a marked development. The number of dairy cows in the South Island totals 274,372, and 2,134 is only 0·78 per cent. of this, while 83,605 is 7·35 per cent. of the total number of dairy cows in New Zealand (1,137,055).

IMPORTATION OF FERTILIZERS, 1922-23.

ANNUAL STATISTICS AND REVIEW.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1923, are now (by the courtesy of the Comptroller of Customs) available, and, together with other data, have been specially compiled for the *Journal* in the accompanying tables.

PHOSPHATIC FERTILIZERS.

Referring to bone products one notices, without any fear of the result, that the amount of bonedust coming into this country continues to decrease. The quantity of bone manures imported during the twelve months is reduced to one-half of the previous year's figures.

The figures for basic slag show an increase of some 6,000 tons. The importation of slag from the United States is being continued, some 6,500 tons coming from that country.

Rock phosphate and guano show an increase of 24,000 tons, which is the best feature of the year. Of the total of 69,591 tons it is satisfactory to notice that 51,000 tons came from Nauru and Ocean Islands, and that if the high phosphate-content of this product is taken into account it will be found that the figures disclose a record for the amount of phosphoric acid imported for manurial purposes during any year. Although the actual tonnage of phosphate imported was less than that of 1921 (the year which holds the record up to the present) the content of phosphoric acid is so much greater that under "rock phosphate and guano" it is estimated that some 3,600 tons more of phosphoric acid was imported in 1923 than in 1921. This amount is chemically equal to the phosphoric acid contained in, say, 21,000 tons of basic slag. Possibly there is no single substance upon which the agricultural prosperity of the North Island is so dependent as phosphoric acid combined in one of the phosphates of lime, and the fact that in hard times such a record had been achieved must be considered extremely satisfactory.

NITROGENOUS AND POTASSIC MANURES; GYPSUM.

Importations of nitrogenous manures show a decrease for the year. Their correct place in the system of manuring in New Zealand has yet to be determined. The figures for potassic compounds are roughly double those of the previous year. Gypsum (hydrated sulphate of lime) is again coming in greater quantities, no doubt to be largely used as a diluent, of which it is one of the best.

SUMMARY OF KINDS, QUANTITIES, AND DECLARED VALUES OF FERTILIZERS IMPORTED DURING YEARS ENDED 31ST MARCH, 1922–23 AND 1921–22.

Fertilizer.	Quantity.		Value.	
	Year 1922–23.	Year 1921–22.	Year 1922–23.	Year 1921–22.
	Tons.	Tons.	£	£
Bonedust	2,446	4,063	24,205	46,981
Bone char	215	594	1,797	4,004
Blood-and-bone	..	50	..	707
Basic slag	19,641	13,488	82,732	83,539
Superphosphate	..	3,140	..	21,906
Rock phosphate (raw) and guano	69,591	45,956	124,672	103,245
Kainit	3,894	2,420	10,481	16,660
Muriate of potash	60		627	
Sulphate of potash	592		6,868	
Potash, other	670		3,270	
Gypsum	1,493	301	2,398	507
Sulphate of ammonia	436	2,058	7,420	28,846
Nitrate of soda	386	204	5,426	3,920
Sulphate of iron	53	26	606	286
Manures unspecified	6	..	286	77
Totals	99,483	72,300	270,788	310,678

NOTE.—With regard to the "declared values" given above, the Comptroller of Customs supplies the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not cover the present freight, insurance, and other charges, the statistical value is less than the actual landed value."

IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS FROM 1913 TO 1923.

Year ended 31st March.	Bonedust.	Basic Slag.	Superphosphate.	Guano and Rock Phosphate.	Egyptian Basic Phosphate.
	Tons.	Tons.	Tons.	Tons.	Tons
1913	9,281	20,133	32,964	25,033	Nil.
1914	6,578	30,350	41,582	22,093	,,
1915	7,966	29,385	54,190	23,983	,,
1916	10,059	10,339	58,013	39,366	2,026
1917	10,386	6,660	31,962	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000
1921	4,440	10,823	40,731	70,208	10,810
1922	4,063	13,488	3,140	45,956	Nil.
1923	2,446	19,641	Nil	69,591	,,

IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR ENDED 31ST MARCH, 1923, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.			Chile.	India.	United States of America.		Pacific and Indian Ocean Islands.		United Kingdom.			Belgium.		France.		Germany.		Netherlands.	Luxemburg.
	Nitrogenous Manures.	Bonedust.	Gypsum.	Nitrogenous Manures.	Bonedust.	Nitrogenous Manures.	Basic Slag.	Name of Island.	Rock Phosphate.	Nitrogenous Manures.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Basic Slag.
								New Caledonia	2,929											
								Nauru ..	18,737											
Auckland ..	80	1,681	1,491	116	750	205	3,250	Ocean ..	20,203	191	3,106	70	6,592	355	..	500	..	2,002	20	150
								Seychelles ..	1,098											
New Plymouth ..	..	205	..	..	..	..	2,300	New Caledonia	509	..	1,000	..	300	..	..	10	..	140	..	..
Wellington ..	20	5	..	..	..	..	961	New Caledonia	315	..	1,150	205	520	25	80	398	100	175	60	..
Napier ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35	..	..	..	..
								Nauru ..	8,828											
Lyttelton ..	..	..	..	75	..	..	..	New Caledonia	931	25	..	10	25	..	..	472	..	125	..	..
Timaru ..	..	..	..	..	..	..	..	New Caledonia	299	..	..	..	..	..	..	..	..	..	..	..
								Nauru ..	4,381											
Dunedin ..	..	10	..	40	..	..	..	Seychelles ..	700	..	..	55	25	..	..	454	..	185	..	..
								New Caledonia	255											
								Malden ..	1,415											
Invercargill ..	..	..	..	..	..	..	..	New Caledonia	1,425											
								Seychelles ..	3,222											
								Tuamotu ..	4,300											

NOTES.—Nauru and Ocean Islands are operated jointly by the British Phosphate Commission. For the previous year's corresponding statistics see *Journal* of May, 1922.

SUPERPHOSPHATE AND THE IMPORTATION OF SULPHUR.

The outstanding feature of the year's statistics is the total absence of superphosphate importations. This must be accounted a very favourable symptom when the cause is known to be that all the superphosphate required is now manufactured in the Dominion, the raw material, except small quantities of sulphur and phosphates locally produced, being obtained from overseas. The fact that New Zealand manufacturers are now able to cope with all internal demands for this valuable artificial phosphate, involving the employ of highly trained chemists and costly plant and machinery, is important from another point of view. The manufacture of superphosphate necessitates the making of sulphuric acid, as it cannot conveniently be imported. The establishment of a superphosphate industry on a large scale is therefore bound to stimulate the manufacture of sulphuric acid. The use of sulphuric acid in manufactures is so general that the amount of it consumed is some indication of a country's industrial development. (Over 5,500,000 tons, worth 10,500,000 dollars, were produced in the United States in 1920.) Superphosphate-making in New Zealand, by stimulating the production of sulphuric acid, is therefore also likely to be of assistance to other industries.

The importation of sulphur into New Zealand is so important from a fertilizer point of view that it is desirable to deal with the subject in this review The following table shows the importations since 1902 :—

Year.	Quantity.	Year.	Quantity.	Year.	Quantity.
	Tons.		Tons.		Tons.
1902 ..	283	1909 ..	1,308	1916 ..	2,444
1903 ..	549	1910 ..	1,599	1917 ..	1,861
1904 ..	747	1911 ..	1,264	1918 ..	3,080
1905 ..	416	1912 ..	2,593	1919 ..	3,234
1906 ..	1,183	1913 ..	1,925	1920 ..	4,165
1907 ..	339	1914 ..	114	1921 ..	4,622
1908 ..	1,607	1915 ..	1,714	1922 ..	9,035

Yearly average 1902–11, 930 tons; yearly average 1912–22, 3,162 tons.

In the past the great bulk of this sulphur has been obtained from Sicily and Japan, the small quantities mined in the thermal district of the North Island being quite inadequate to fill the local demand. During 1922 8,500 tons of sulphur was imported from the United States, a fact which brings New Zealand manufacturers into economic touch with an industry—the sulphur-mining of Louisiana—the story of which is one of the most romantic in the history of industrial enterprise

In 1865 petroleum-boring operations in Louisiana disclosed the presence of a sulphur deposit beneath a layer of quicksand about 500 ft. thick. A good deal of money was lost in legal actions before a decision could be reached as to whether the right to exploit petroleum included the right to mine sulphur; but the losers in the action were more fortunate than those who established their right to the sulphur, for the latter lost more money in trying to bring the sulphur to the surface. In fact, the deposit brought misfortune to all who up to this time

attempted to work it. An Austrian company, a French company, and numerous American companies failed, and not a ton of sulphur was produced. The solution of this extraordinary problem in mining of how to bring to the surface from anything up to 1,000 ft. below it a deposit of solid pure sulphur (melting-point 292° F.) which was covered by layers of quicksand and limestone rock was finally solved by Herman Frasch, one of the greatest of American chemical engineers. In 1891 he became interested in the problem, which had cost some their lives and others their money, while all were baffled. At this time the sulphur demands of the world were supplied from Sicily and Japan. In both countries labour was cheap, the Sicilian receiving about 2s. 6d. a day, whereas American miners required 5 dollars at least; but the question of wages was one of the smallest troubles to be surmounted. The difficulties of drilling through quicksand to determine finally the character of the deposit were sufficiently tedious, taking from six to nine months to do what could be done in as many days with ordinary rock. The engineer had previously decided that the only way—an entirely novel one—to mine this sulphur was to melt it in the ground and pump it on to the surface in the form of a liquid. The melting-fluid consisted of water superheated to 335° F. in columns in which 100 lb. per square inch pressure was maintained, and which was sent down to the deposit through a specially constructed double pipe, the pressure forcing the melted sulphur up through the inner pipe.

After the initial demonstration of the success of this method it was not until 1903, or some twelve years later, that all the difficulties had been surmounted and the proprietors could see financial success ahead. In that year was produced 122,000 tons of pure sulphur, which was more than the consumption for the whole world for one year at that date. Of the subsequent success which attended this enterprise it is sufficient to say that in 1912 the average output of sulphur from the mine was 250,000 tons of sulphur guaranteed 99·5 per cent. purity, and it is stated that the only limitation of output is the market demand. The industry now entails that enormous quantities of water should be superheated in about 160 boilers of a total capacity of 25,000 horse-power. As the sulphur flows up it is pumped into movable bins. As the deposit on the surface grows in thickness, cools, and solidifies, the sides of the bins are raised. Blocks of pure sulphur are thus formed which weigh thousands of tons. The sulphur is blasted away from these blocks and loaded into trucks by machinery capable of loading a 35-ton truck in fourteen minutes. The sulphur is railed to Sabine, a port in southern Texas, where it is possible to load a 7,500-ton steamer within twelve hours.

The sulphur produced in 1921 in the United States amounted to 1,879,150 long tons, about one-third more than was produced in 1920. The shipments were one-third less than in 1920. It would therefore appear that large stocks are now on hand and available for export to New Zealand or any other country which can absorb the surplus. In 1920 and in 1921, as in former years, 99·5 per cent. of the sulphur produced in the United States came from the deposits in Texas and Louisiana.

New Rabbit District.—The Cheltenham Rabbit District (Wellington) has been constituted for the purposes of Part III of the Rabbit Nuisance Amendment Act, 1918.

LIMING FOR WESTLAND SOILS.

TESTS AT WAIMAUNGA EXPERIMENTAL FARM.

C. S. DALGLIESH, Fields Instructor, Hokitika.

ANALYSES of South Island West Coast soils show that their lime-requirement in carbonate of lime ranges from 1 ton to 6 tons per acre. The practical experiences of many farmers and the results of work carried out by the Department of Agriculture at Waimaunga Experimental Farm and in other local districts clearly demonstrate that liming is the basic principle of agriculture on this coast, and that only a meagre amount of cultivation can be undertaken without its use.

Waimaunga Farm soils show a lime-deficiency of 2 tons to 3 tons per acre. This farm is situated in the northern end of Grey Valley, thirteen miles south of Reefton. The land brought under cultivation since the Department took possession is light, and very fairly representative of the lighter lands of the West Coast. The grassland mainly consisted of fiorin and sweet vernal, there being a complete absence of clovers and the better-class grasses. The capacity of such pastures, either for stock-raising or milk-production, is very low. Subsequent to the breaking-in of the land by previous owners of the property good crops of oats and turnips were grown, but the better grasses did not hold for any length of time, and clovers never did thrive.

Field 1 at Waimaunga—light, shallow land, stony in places—was ploughed in the winter of 1921, cultivated in the spring, and given 1 ton of ground burnt lime per acre. The area was sown in temporary pasture of rye-grass and clovers in November, 2 cwt. of superphosphate per acre being used as a manure. An excellent pasture resulted, with clovers prolific. The field was grazed with stock from January to the beginning of September, 1922, and then closed up to the end of October. From 31st October to 14th November it carried store bullocks at the rate of one per acre; from then to the last day of November it carried two bullocks per acre. It was then spelled with the intention of again stocking in three weeks' time, but plenty of other feed being available it was not until 14th January last that stock was again put on. There was a great growth of feed—an ideal clover-hay crop. From then to the middle of February the field was heavily stocked with store bullocks and sheep, then given three weeks' spell; it has carried since six sheep per acre and more than held its own.

Field 2 was ploughed in January, 1921, cultivated during February and March, and limed at the rate of 2 tons per acre, with the exception of a strip 1 chain in width lengthwise through the field, this being left unlimed. The field was thus left during the winter; in the spring it received light cultivation and was again ploughed, and 4½ acres made ready and sown in root crops in December, the remainder of the field being fallowed. The crops grown were swedes, turnips, and carrots, also Thousand-headed kale. Ten days previous to these crops being sown, purely as an experiment, an additional 12 cwt. of lime per acre

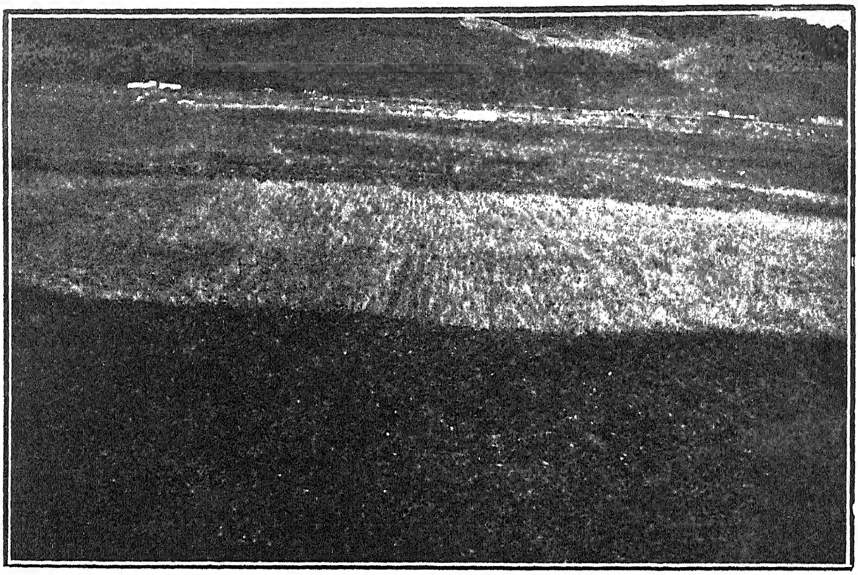


FIG. 1. FIELD 2 AT WAIMAUNGA EXPERIMENTAL FARM, SHOWING CONDITION OF TEMPORARY PASTURE ON LIMED AND UNLIMED LAND.

This photo was taken three weeks after harvesting of the oat crop. The light-coloured area in centre is the unlimed strip, the clover growth showing dark on the limed land on both sides.

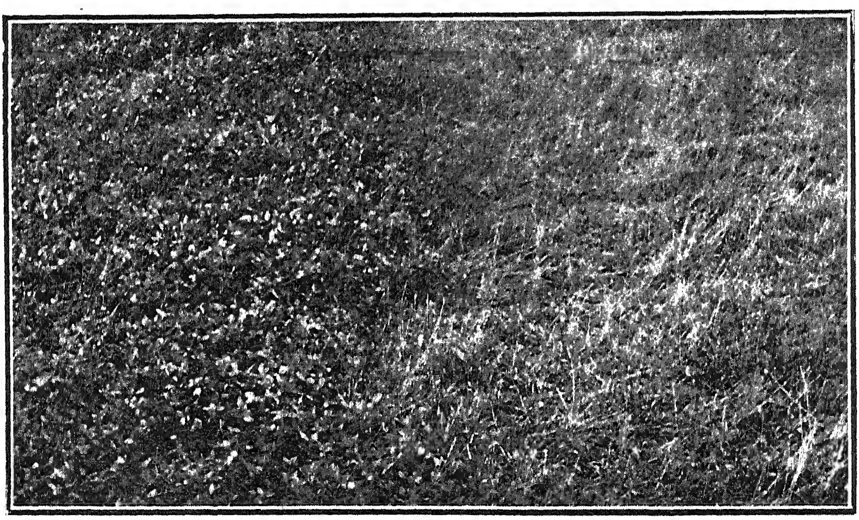


FIG. 2. CLOSER VIEW OF THE TEMPORARY PASTURE IN FIELD 2.

Showing (to right) the stubble of the oat crop and poor pasture on the unlimed strip, and good clover-growth (to left) on limed area.

was applied to a certain area on each side of the field. The manure used was 2 cwt. superphosphate per acre.

The root crops gave the following average yields per acre :—

Crops.	2 Tons Lime in Autumn.		2 Tons Lime in Autumn with 12 Cwt. additional previous to Sowing.		No Lime.	
	Tons	Cwt.	Tons	Cwt.	Tons	Cwt.
Swedes	25	13	30	9	10	11
Turnips	23	7	26	0	14	3½

The carrots were a poor crop all through, being sown rather late to ensure a good result, and a complete failure on the unlimed land. The Thousand-headed kale gave a very fair crop on the limed areas, but there was a complete absence of plants on the unlimed land.

The root crops were fed off with stock during the winter, and the land ploughed in the spring. With the exception of 2 acres reserved for swede manurial trials, the field was sown in Algerian oats and temporary pasture of Italian rye-grass and cow-grass. A proprietary fertilizer was used at the rate of 2 cwt. per acre ; a strip ½ chain in width running across the field was left without manure. From the commencement of growth the oats on the unlimed strip lagged far behind, being poor and yellow in colour in the early stages of growth and finishing as a very poor crop indeed. The unmanured part showed a very backward growth for the first five to six weeks ; after that it came on remarkably well, but at time of harvest was of shorter growth and gave a smaller yield than did the manured area. The yields of chaff per acre were as follows : Limed and manured area, 37 cwt. ; limed, without manure, 32 cwt. ; unlimed, with manure, 9 cwt. ; unlimed, and no manure, 7 cwt.

The temporary pasture made great growth on all but the unlimed strip, and on the lighter parts of the field seemed to retard the growth of the oat crop. On the unlimed part the pasture is extremely poor—in fact, can scarcely be termed a pasture, the grass sown being thin and weak, and the clover sparse and yellow in appearance. The line of difference in growth between the limed and unlimed land is strongly defined, as shown by Figs. 1 and 2.

The 2 acres reserved for swede manurial trials in this same field was sown with Superlative in the second week of December, and twenty different manures given a trial. The results have been a failure on the unlimed part, swedes failing to braird on many plots and very poorly on others, with subsequent stunted growth. Phosphatic manures gave the best braird ; basic slag gave much the best result on the unlimed land ; the nitrogenous manure plots were slow to start growth, and a complete failure on the unlimed land. Fig. 3 shows the scanty growth of swedes on the unlimed part as against a fair growth on the limed area.

Field 3 was sown in permanent pasture in the autumn of 1922, with 2 cwt. superphosphate per acre. Half of the field had received 1 ton of lime per acre and the other half 2 tons during the previous late winter and early spring when in preparation to be sown in oats

and vetches and oats and peas; the manure for the latter crops being 2 cwt. per acre of one part superphosphate and one part Ephos phosphate. Very heavy crops of oats and vetches, and oats and peas, were secured. The pasture is excellent, with a good sole of clovers, and is carrying stock well. Both parts of the field—1 ton and 2 tons of lime respectively—have given equally good results.

Field 4 was sown in pasture in February, 1921, 2 tons of lime per acre being applied during preparatory cultivation operations. Manure, 1 part superphosphate and 2 parts Ephos phosphate, was applied at 2 cwt. per acre. This is now a first-class pasture, carrying stock well. A very good crop of clover hay, averaging 2 tons per acre, was harvested in January, 1922.

Field 5 differs in formation from the major portion of the farm, being of river-flat formation of a free sandy nature. This field was

FIG. 3. SWEDE CROP IN FIELD 2, SEASON 1922–23.

Showing failure of swedes on unlimed land (to right) and fair growth on limed ground (to left).

cleared of gorse and blackberry, ploughed in late autumn and winter, and part sown in a broadcast swede crop in December. The greater part received a second ploughing in preparing the land for the crop. The field, with the exception of a strip 1 chain in width in the centre, received an application of 5 cwt. of lime per acre, and was manured with 1 cwt. bonedust per acre. The crop was only medium. The braird was very much poorer and growth stunted on the unlimed in comparison with the limed portions.

Field 7 was ploughed in the winter of 1921, preparatory to being sown in oats. It was intended that one-half of the field be limed at the rate of 1 ton per acre and the remainder be not limed. Owing to the full quantity not being available when required only a few acres

received the application of lime. Dun oats were sown in the spring with 2 cwt. of superphosphate as a manure. A very fair crop resulted, being better on the limed portion, with stronger growth.

This field has not been ploughed since, and has reverted to a fiorin and sweet-vernal pasture. The striking and prominent feature of this natural succession is the growth of superior pasture-plants on the few acres which were limed, also its preferential treatment by stock, both facts emphasizing the great value of lime for such soils. These few acres are carrying what can be termed a good second-class pasture (white clover, Lotus major, and a fair proportion of rye-grass), which is kept closely grazed down by stock. It also carries a vigorous growth of Scotch thistles. The remainder of the field is comprised of a fiorin and sweet-vernal pasture in full seed (at time of writing), not being relished by stock. There is also an absence of thistles.

An account of liming and manurial experiments in other districts of the West Coast will follow.

CONTROL OF PROPRIETARY STOCK-FOODS.

LEGISLATIVE MEASURES IN OTHER COUNTRIES.

COMPLAINTS have been received from time to time by the Department regarding proprietary stock-foods and condiments on the local market. There are, of course, many good genuine stock-foods on the market, but close examination has proved other preparations to consist more or less of cheap ingredients having little or no nutritive value, while in one instance analysis of a certain proprietary mixture, prompted by the ill effects which followed its consumption by pigs, showed it to contain substances actually poisonous.

For the information of farmers and others, summaries of legislative measures adopted by certain other countries in dealing with this matter have been prepared and are here presented. The chief points suggested are that all proprietary live-stock and poultry foods, condiments, and tonics should be registered; and that an invoice certificate showing the composition and food value of the preparation, as determined by analysis, be made the basis of every sale—the vendor being liable to penalty if the article proves to be below the standard indicated in the invoice. This would put the sale of stock-foods on an equal footing with the sale of fertilizers, and would afford the farmer the same protection as he now enjoys in respect of the latter.

THE QUEENSLAND LAW.

Queensland possesses a very complete measure for the control of stock-foods, as apart from purely medicinal preparations, in the Stock Foods Act of 1919. This statute covers foods for horses, mules, asses, cattle, sheep, goats, pigs, dogs, domestic fowls, turkeys, geese, ducks, pigeons, and birds in captivity, these being divided into three classes —namely, mixed concentrated or prepared stock-foods, comprising foods

or meals prepared from one or more than one kind of grain, or from oils, juices, meats, or other sources, and condimental foods having nutritive as well as medicinal properties; by-products, such as bran, pollard, brewers' grains, and materials produced from any kind of grain or seed in any process of manufacture, not being the primary object of such process; and fodders, such as hay, straw, chaff, &c.

In the case of prepared stock-foods and such by-products as are prescribed in regulations under the Act, the person primarily responsible for their being placed on the market must, before selling, and annually thereafter, forward to the Under-Secretary, Department of Agriculture and Stock, Brisbane, samples of at least 2 lb. in weight of each such food. Each sample must be accompanied by (1) a statutory declaration stating that it is a fair average sample, and giving the specific name and proportion of each of the original grains, seeds, or other ingredients contained in it; and (2) a specimen copy of the invoice certificate, of all directions for use, and of the label to be affixed to every package of the food sold, showing the net weight of food, the name or trade-mark, the name and address of the principal seller, the chemical analysis of the food according to the method prescribed, and the specific name of each of the original ingredients. If at any time the composition of the food is varied, notice to that effect must immediately be given. Chemical analysis is not required for poultry-corn composed of whole grain only, nor for bird-seed.

Retail sellers repacking the food in smaller packages must affix to the latter a label showing all the particulars shown on the original label, together with the net weight of food in the package, and their own name and address, such label to be of a different colour from the original. Where such practice is adopted the onus is on the retail dealer to prove that the food in the smaller package is of the same composition as that in the original package.

Upon the sale of any stock-foods not required by the Act to be labelled, or on the request of the buyer in the case of labelled foods, the vendor must, within seven days of delivery, supply an invoice stating the quantities sold and the specific materials of which the food consists, such statement to act as a warranty that the food consists solely of the materials specified and in the proportions given; that it contains no greater amount of foreign ingredients than is allowable; that it is suitable for stock-food and for the kind of stock specified; and that the particulars regarding weights, &c., are correct.

As regards sales of mixed hays, straws, and chaffs, the Act provides that the invoice shall specify each component part of such mixed fodders, and that in the case of chaff each package of straw-chaff shall be distinctly marked with the letters SC, and each package of mixed hay and straw chaff with the letters MS.

Detailed instructions are laid down regarding the taking of samples, and provision is made for the appointment of officers with power to sample all stock-food sold, or exposed or prepared for sale, on paying the ordinary market price for the quantity taken. A purchaser may also take for analysis, within fourteen days of delivery, a sample of the stock-food supplied, provided he gives notice in writing of his intention to the vendor, in order that the latter may be present, should he so desire,

when the sample is taken. It is provided that wherever possible samples shall be taken in the presence of the seller or his agent, whose signature, together with that of the person taking the sample, must then be appended to the label on each sample.

Samples are divided into three parts and sealed, one being handed to the seller and the other two forwarded to the Under-Secretary of the Department of Agriculture and Stock for analysis. Where any deficiency or irregularity is disclosed, proceedings are taken against the vendor, on whom lies the onus of proving that no offence against the Act has been committed. A maximum penalty of six months' imprisonment and a fine of £100 is provided for, while a defrauded purchaser also retains the right of recovery by civil action.

Power is provided for the Governor in Council to make regulations under the Act prescribing those stock-foods and by-products to which the Act shall apply, the amount and character of foreign ingredients allowable in stock-foods, the forms and labels to be used, and fixing a fair average standard for any class of stock-food.

In connection with the administration of this Act, which has now been in force for three years, the Under-Secretary of the Queensland Department of Agriculture and Stock stated, when communicated with, that the difficulty experienced with regard to proprietary articles had been not so much the reluctance on the part of manufacturers to give the specific names of each of the materials used as the inability of some to fix a definite standard and make all food sold under a particular brand conform to the facts expressed in the statutory declaration. There was no doubt, however, that manufacturers had now standardized their methods, and were putting on the market an article of better value. Another good effect of the Act's operation was that several stock-foods for which exaggerated claims were being made had since disappeared from the market, while the accessibility of full particulars regarding composition had no doubt prevented other inferior preparations from being placed on sale.

LAW OF THE UNITED KINGDOM.

The English law on this subject is contained in the Fertilizers and Feeding-stuffs Act, 1906, and provides that the vendor of any artificially prepared stock-food shall give to the purchaser an invoice stating the name, ingredients, and the percentages of oils and albuminoids contained in it, such invoice to act as a warranty as to the facts so stated, except in so far as certain degrees of error are allowed as regards percentages. There is also an implied warranty that the preparation is suitable for the purpose for which it is sold. Should the name be such as to imply that the article has been prepared from one or more particular ingredients, without indication that others are compounded in it, the law presumes that it contains only the indicated substances. The vendor is not liable (1) if he did not know and could not with reasonable care have ascertained that the invoice was false, or (2) if he relied on an invoice given by a person in the United Kingdom. Where the food has been prepared under the detailed instructions of a purchaser, the vendor's certificate need only give the analyses of the component ingredients.

The various county and borough authorities are empowered to appoint analysts and samplers under the Act, the approval of the Ministry of Agriculture being required in respect of each appointment. A purchaser of stock-food may, on payment of a fee, accompanied by a sample and a copy of the invoice certificate, obtain from the local analyst an analysis of such sample. Should he contemplate legal proceedings, the sample must be taken within ten days after delivery of the consignment, and in accordance with the method laid down in regulations under the Act, or he may request the official sampler to take the sample. The latter may also take samples of any feeding-stuff sold or exposed for sale at his discretion. If analysis by the local analyst shows the food to be inferior to the guaranteed quality a second portion of the same sample is analysed by the Chief Analyst, and if this confirms the local analysis proceedings under the Act are instituted against the vendor, who is liable to a fine of £20 for a first offence and £50 for any subsequent breach. In addition, the purchaser prejudiced by the misdescription of the food is entitled to any civil remedy he may otherwise have had. Penalties are also provided for any other breach of the Act, and for any act tending to obstruct its operation.

UNITED STATES MEASURES.

In the United States of America each State makes its own laws governing the sale of stock-foods within its borders. It will be sufficient to instance the State of Iowa, where there are special laws regulating the sale of these products, the enforcement of which is in the hands of the State Dairy and Food Commissioner. This officer issues a license in respect of each condimental, patent, proprietary, or trade-mark stock-food, based upon an analysis for nutritive value, and carries out periodical analyses to ensure compliance with the law. He also analyses samples at the request of purchasers of stock-food, and will institute proceedings against the vendor if necessary. A feature of this administration is that the Commissioner will also assist a defrauded purchaser to obtain restitution to the extent of any deficiency, this service being given without charge.

Noxious Weeds.—The Mongonui County has declared Cape honeyflower, and the Inglewood County broom, foxglove, gorse, ox-eye daisy, pennyroyal, St. John's wort, spiderwort, and barberry, to be noxious weeds in the respective districts under their jurisdiction.

Ruakura Sale of Pedigree Stock.—The fourth annual sale at the Ruakura Farm of Instruction, held on 18th April, attracted a large attendance of buyers, and competition was good, very few lots being passed in. Twenty-three lots of Darbalara Milking Shorthorn bull calves realized an average of 33 guineas, Dominion Manilla of Ruakura and Dominion Might of Ruakura bringing the highest price, at 60 guineas each. Five Jersey bull calves were sold for 20 guineas each. Milking Shorthorn two- and three-year-old females (fifteen lots sold) averaged 30 guineas, the highest price received being for Dominion Moireen of Ruakura, at 60 guineas. For sixteen Berkshire boars sold the average price was 5½ guineas, and the highest price 11 guineas; while for twenty-three Berkshire sows the average was 8 guineas and the top figure 13½ guineas. Considering the present state of the live-stock market, the prices realized for such young animals were highly satisfactory. Most of the pigs offered ranged from four to five months old.

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

II. THE BIRDS OF THE FOREST.

J. G. MYERS, B.Sc., F.E.S., R.A.O.U., and ESMOND ATKINSON,
Biological Laboratory, Wellington.

AT a time immeasurably remote—somewhere about the close of the Secondary era—New Zealand formed the south-western extension of a great continent stretching north to Fiji and New Guinea. In that far-distant period the portion which was to survive as New Zealand when all the remaining links sank beneath the surface of the ocean was colonized by most of its land-birds—or, rather, by most of the ancestors of the birds which were later to constitute the most extraordinary avine population on the face of the globe. The connecting-links sank—and through all the æons of the Tertiary era to, comparatively speaking, the present day New Zealand was cut off from the rest of the world.

At the time when New Zealand was last connected with larger land-masses mammals had either not yet been evolved from the common reptile-like stock from which our present lizards and snakes and the birds themselves have arisen, or else they had not yet reached a land by means of which they could spread to this country. The birds, then, were the highest evolved inhabitants of this isolated land. It was a heavily wooded country. The birds and the forest grew in beauty side by side: on their indissoluble interdependence, the importance of which has never hitherto been adequately realized, more emphasis will be laid later. Thus this ancient New Zealand was above all else a land of birds; no other land-mass so large has remained isolated so long, and in no other area of any considerable size have birds achieved terrestrial domination. Such an unusual state of affairs was certain to produce extraordinary results.

Of these consequences the one which forms the subject of the present article is that which concerns the relation of the indigenous land-birds to the forest; and we cannot sum up this relation better than in the words of Mr. L. MacIntosh Ellis, Director of the State Forest Service, who states that no other forest that he knows is so dependent on birds as that of New Zealand—in fact, "no birds, no forest."

The activities of birds in the forest may be discussed under three main headings: (1) Birds as the chief agents in keeping forest insect pests in check; (2) as pollinators of the flowers of forest-trees; (3) as distributors of the seeds of forest-trees, and thus as agents in the establishment of forest.

Now, whereas in New Zealand birds are extremely important factors in all these three respects, in the great pine-forests of the north of the Old and New Worlds practically their sole service is in the war against insect pests. The flowers of all the northern pines and of a

very large proportion of the deciduous forest-trees are pollinated by the wind, and the same agency is responsible for the carrying of the seed to new ground.

A visitor to New Zealand hitherto acquainted only with these great northern forests would be startled if, when his eyes fell for the first time on such remnants of forest as he would see in travelling by rail from Auckland to Wellington, he were told that from forests like these came the bulk of the commercial timbers of New Zealand. Nor would a close inspection of this type of forest—the "mixed bush" of the settler, the "rain forest" of the botanist—lessen his surprise. The great number of different kinds of trees and shrubs growing in association with one another, the tree-ferns, the perching plants high up on the limbs of the tall trees, and the network—in some places almost inpenetrable—of climbing plants would fill him with wonder. If he were interested in such things and saw again with his mind's eye the northern pine forests in their flowering season, the air dim with drifting pollen, and later filled with winged seeds fluttering away from their parent trees, he might well ask himself the question whether in these strangely different New Zealand forests there must not be other agencies at work besides that with which he was so familiar, the wind. How many of us, even of those who have spent their lives in the bush, could answer his question at all adequately? It would take years of careful research to find out in the case of each species of tree or shrub of the New Zealand forests exactly how pollination (transference of the male cell, or pollen-grain, from the anthers to the receptive female organ, or stigma) and dissemination (dispersal of the seeds) are brought about. All that is attempted in the present article is to collect some of the few facts that are known as to the part played by New Zealand forest-birds in pollination and dissemination, those two silent processes without which the forest would, if left to itself, dwindle day by day until at last it vanished utterly.

POLLINATION.

As regards New Zealand forests there are three agents by which pollination is effected—wind, insects, and birds. The total number of forest-plants in New Zealand is a large one, even when there are excluded from it all the ferns and their allies, and such trees and shrubs as from their rarity may be considered negligible. A list of this sort, which is of necessity a more or less arbitrary one, has been prepared by the writers, and from it has been obtained the following rough proportion of plants which fall under each of the headings just stated—namely, wind-pollinated, 40 per cent.; insect-pollinated, 47 per cent.; and bird-pollinated, 13 per cent.

These figures show that the bird-pollinated plants form but a small percentage of the whole, but, curiously enough, they include several most important timber-trees—the northern and southern ratas (*Metrosideros robusta* and *M. lucida*), the pohutukawa (*M. tomentosa*), the puriri (*Vitex lucens*), and the rewarewa or honeysuckle (*Knightia excelsa*). Insects no doubt play a part in the pollination of the ratas and pohutukawa, but the puriri, which is the most valuable hardwood in New Zealand, and the rewarewa, so well known and largely used as

an ornamental timber, appear to be absolutely dependent on birds for their pollination. The actual processes in the case of these two trees have been carefully investigated, the rewarewa having been studied by Mr. T. F. Cheeseman, and the puriri by Dr. D. Petrie.

Though the puriri has not as wide a distribution in nature as the rewarewa it is often cultivated and flowers when quite young, so that the visits of birds to the flowers may be easily observed. After describing the structure of the flower Dr. Petrie goes on to say: "Though the secretion of nectar is both abundant and long-continued, flying-insects do not frequent the flowers; and, indeed, the store of nectar is so carefully protected by the natural plug of matted hairs obstructing the corolla-tube that insects could reach it only by biting through the base of the corolla-tube, and this I have never known to occur. There is no doubt that pollination is effected exclusively by small birds. These constantly visit the flowers, hang on to the rigid leaf-stalks or flower-stalks, and insert their bills into the corolla-tube and suck the nectar. In sucking the sweet juice the tui may be seen grasping a flower in one foot and turning it round into a more convenient position. In passing from flower to flower the birds cannot avoid bringing pollen from young flowers to older ones and so effecting pollination."

Besides the valuable trees already mentioned as being dependent on birds for their pollination, there are several other small trees and shrubs which without the same agency would produce no fruit. Some, apart from anything else, are not of wide enough distribution to be considered in an article dealing with the forest in general; but there is one, the common fuchsia (*Fuchsia excorticata*), which is abundant in nearly every gully in the country and often extends far up their sides, where it is conspicuous in winter owing to its leafless habit and reddish branches. Every one well acquainted with the bush has seen the tui hanging head downwards on a fuchsia-branch thrusting its bill into the pendulous flowers in search of nectar. The rarer makomako, or bell-bird, with its much lighter-coloured plumage, often shows in the flowering season of the fuchsia a bright-blue stain on its head near the base of the bill, which is clear evidence of the part it too has been playing as a pollinator of the fuchsia.

Perhaps it may be asked why the fuchsia, which is of little commercial value, is included in an article seeking to show the value from a utilitarian standpoint of the birds of New Zealand. Nevertheless, the fuchsia, together with other small trees such as the mahoe (*Melicytus ramiflorus*), wineberry (*Aristotelia serrata*), and the "five-fingers" (*Nothopanax* spp.), which have bird-carried fruits, does play an important part in the regeneration of the New Zealand forests. It stabilizes the lower, often stony or clayey, slopes of many valleys which otherwise would suffer much from erosion, and by affording shelter to ferns and other small plants helps to form a seed-bed for the young plants of many timber-trees. Although it does not really come within the scope of the present article, the part played by the honey-eating birds in pollinating the various kinds of eucalypts now grown in New Zealand must at least be mentioned. It is a common sight to see tuis and bell-birds among the flowers in blue-gum plantations, even in well-settled districts where there is but little bush.

DISPERSAL OF TREE-SEEDS.

It has not been possible—in the case of forests in other parts of the world—to obtain figures showing the proportion borne by bird-disseminated plants to those in which the seeds or fruits are dispersed by the wind, but it may be safely said that in New Zealand the number of the former compared to the total is remarkably great. Working on a similar basis to that employed in calculating the proportion of bird-pollinated plants, the writers have found that about 65 per cent. of what may be fairly called forest-plants have more or less succulent fruit attractive to birds. Probably some tropical forests would show a similar proportion, but many mammals would be competing with the birds, and the part played by the latter in dissemination would be of less comparative importance.

Any one looking up a book of reference with a view to learning something of the timber-trees of the world could not help being impressed by the importance of the position occupied by the many different kinds of pines and firs in the Northern Hemisphere, and by the wonderful array of Australian hardwoods of the genus *Eucalyptus*. Every one of these trees owes its dissemination entirely to the wind. Now turn again to a consideration of the New Zealand forests and think of the timber-trees of which we are so justly proud. It is true that the most famous of all, the Kauri (*Agathis australis*) is disseminated by the wind; but there are many others hardly less valuable which have succulent fruits. Among these may be mentioned the totara (*Podocarpus totara*), matai (*P. spicatus*), white-pine (*P. dacrydioides*), and rimu (*Dacrydium cupressinum*). Other allied trees of less general importance but still of great value are Hall's totara (*Podocarpus Hallii*) and the miro (*P. ferrugineus*). Several trees closely allied to the rimu yield splendid timbers, though the majority of these are rare. The Westland or silver pine (*Dacrydium Colensoi*) must, however, be specially mentioned, as it is abundant on the West Coast, and as regards the quality of its timber is one of the most valuable trees in New Zealand. Every one of these taxads (as the trees of the yew family are called) is dependent on birds for the dispersal of its fruits.

It has been pointed out that the seeds of such trees would still reach the ground and be able to germinate there, even if the forests were quite birdless, simply by the falling of these fruits to the ground beneath the trees. This is quite true, and every bushman has seen the ground red with fallen fruit beneath such trees as rimu, particularly since the fruit-eating birds have become so much scarcer; but he knows also how rare a thing it is to find any young rimu-plants in such a situation. No attempt to explain this fact—which is noticeable in the case of many of the other taxads—is made here. It is only noted as a fact; but it is at once obvious that the regeneration of trees like these depends on more than the production of a large supply of fruit. The seeds must be distributed so that some at least will fall on ground where the conditions are favourable to the development of the young plant.

The difference between the potential value of a crop of seeds dropped beneath the parent tree and the same number carried far and wide over miles of country offering a variety of conditions suitable

to the development of the seedlings must be obvious to all. The young plants of many of the taxads already mentioned and those of a large number of other timber-trees find a suitable environment under the shade of those smaller trees and shrubs which form, as it were, the lower stories of the forest, fill up gaps between the larger trees, and fringe the edges where fire has been running. It is not proposed to give a list of these, but their number is very great, and the vast majority of them bear fruits attractive to birds. A few may be mentioned, however (besides those named on p. 302), such as the so-called matipo and the tarata (*Pittosporum* spp.), kaikomako (*Pennantia corymbosa*), ramarama (*Myrtus bullata*), pigeonwood (*Hedycarya arborea*), and many species of *Coprosma*, the larger-leaved kinds of which are generally called "karamu" by the settler. Of the timber-trees with fruits attractive to birds the taxads alone have so far been mentioned, but there are many others which should be included here if justice is to be done to the birds. Among them are the puriri, black-maire (*Olea Cunninghamii*), tawa (*Beilschmeidia tawa*), taraire (*B. taraire*), broadleaf (*Griselinia littoralis*), titoki (*Alectryon excelsum*), and the kohekohe (*Dysoxylum spectabile*)—the dearest timber in New Zealand at the present day.

Although the fruit-eating birds have been frequently mentioned, it has been in general terms only. The pigeon is undoubtedly the most important, on account not only of its voracious appetite and varied tastes, but also in virtue of its size, which enables it to swallow the largest fruits; and perhaps of all the forest birds, the pigeon is the most persecuted!

CHECKING OF INSECT PESTS.

There are in New Zealand thirty-six kinds of indigenous birds which are predominantly forest-dwellers. Of this total no fewer than twenty-eight subsist either wholly or in part on insects, sixteen live chiefly or partially on berries, and five suck nectar from the flowers of forest-trees and thus act as the chief agents of pollination. Two kinds of forest-birds only—namely, the bush-hawk and the quail-hawk (not to be confused with the harrier-hawk), which by several good authorities are considered only one species—appear at first sight to play no part whatever in the beneficial activities of the forest-birds. In fact, their own activities in destroying more useful birds might, from the human standpoint, be regarded as totally injurious were it not borne in mind that seeds from the crops of their victims find their way into the hawk's own stomach and are thus efficiently distributed.

In Canada the Dominion Entomologist has characterized birds as the most valuable insecticidal agency known. A little thought will convince any one familiar with the New Zealand bush and with its inhabitants that the scrutiny of every crevice of the bark, every twig, and every leaf by the birds is almost inconceivably minute. One of the writers was able to demonstrate this in a way which was so conclusive that, although the insect pest in question was not a forest one, a few details may be permitted here. A branch of rose-bush, almost literally covered with masses of green aphis or "green-fly," was placed in a tree remote from the house and watched. In a few minutes it had attracted the notice of a travelling party of white-eyes

(wax-eyes, or blightbirds); in less than half an hour the rose-branch, which was several feet long, was as clean of aphis as though it had been repeatedly dipped in a strong spray solution. Spraying is utterly impracticable in the case of forest insect pests, but there is in the birds an agency almost as efficient, perennially active, and costing nothing. Unfortunately, nearly every influence which European civilization brought into this country was deleterious to the indigenous birds—to these natural guardians of our forest wealth; and the birds have sadly decreased to such an extent that it becomes an essential part of forest policy in this Dominion to restore them to something like their former numbers. Certainly the native birds are protected by law, but something more than that is needed. People whose work takes them to the bush should learn what is owed to the birds, and a personal responsibility in the matter of bird-protection should be recognized by all.

It is a common occurrence to find in the bush a tree riddled by the "huhu" grub—the fleshy legless brown larva of a large beetle (*Prionoplus reticularis*). Such trees, whether dead or alive, have often considerable areas of softer material composed of sawdust and decayed wood supported by strong and resistant bands of still sound timber. For extracting the huhus from such a log a man would probably choose a stout knife for digging into the decayed and softer portions, while those larvæ which were deeply ensconced in crevices of the sounder timber would be conveniently extracted by means of a long pair of forceps. The huia—now, unfortunately for our forests, so rare that there is considerable ground for supposing it extinct—became so adapted to live upon wood-boring insects (and perhaps specially on the huhu) that it actually possesses the instruments suggested above as the most suitable for removing huhus from semi-decayed trees. The huia is unique in that the shape of the beak—a character so constant that it is used extensively in the classification of birds—is different in both sexes. The male's bill is moderately short and very stout, while that of the female is long, curved, and more pliable. When a pair of these birds is working on a tree-trunk, such as described above, the male chisels away the softer material and literally digs out the larvæ, while his mate inserts her long bill into the crevices and holes in the sounder wood, and deftly extracts the larvæ that are lurking there.

The forest, with the insects which prey upon its various constituent plants, may be divided into several horizontal layers. In each of the particular insect habitats thus delimited we have a special army of birds confining its insectivorous energies to that one habitat. Commencing at the forest-floor—that crowded lumber-room of leaf-mould, decaying logs, ferns, mosses, liverworts, fungi, and such seedlings as can grow in this stratum—the insects of this layer may be divided into permanent inhabitants which spend there their whole life-history from egg to adult, and insects of which only a portion of the life-cycle is passed on the ground, the portion spent there being usually either that of the egg or pupa (resting stage) or both, and less frequently that of the larva. The forest-floor is thus important from the economic viewpoint as a nursery for numerous insects which in their later stages will be destructive to the wood or leaves. The

policemen of this bottom layer are pre-eminently the kiwis and the wekas — both flightless birds which have suffered severely from "civilization." The sensitive nostrils at the top of the bill, together with the strong clawed feet, render the kiwi efficient in discovering among the debris grubs and insects of various kinds. The incessant curiosity of the weka, his persistent "howking" among rubbish and leaves, guided by his unrivalled eyesight, leaves no insect safe. In fact, as a high authority in the United States has written, "it is probable that no species of insect is so completely protected by its habits of life that it is not found and preyed upon, at one or another stage of life, by some species of bird." The activities of these larger birds are supplemented by the North Island and South Island robins, tame and familiar birds whose habit of feeding so largely on the forest-floor, thereby rendering them more liable to the attacks of ground-vermin, has probably been a potent factor in their widespread decrease. There are four other species which obtain the greater portion of their food from the ground. These are the North Island and South Island thrushes (now almost extinct) and the white-breasted and yellow-breasted tits, which, following a great decrease, are now in considerable numbers almost anywhere where forest remains, thus incidentally affording a proof that our native birds are not gone irrevocably. The green wren—a rare bird confined almost solely to the great beech forests—and the little rifleman, our smallest bird, frequently extend their arboreal researches to the ground at the base of the trunks. So much for the forest-floor.

The trunks of the trees and the larger branches, with their dense coating of mosses, ferns, and other perching-plants, and of creepers, form the chief hunting-ground for the rifleman, which wanders over every inch of the surface, probing with its awl-like slightly upturned bill into crannies and cracks and into the damp recesses of moss cushions. The green wren in its search for the insects which constitute its food employs a similar method. The same scene of operations is shared by the saddleback, huia, and kaka, all of which obtain their insect prey from decayed wood and among the bases of epiphytes and masses of creeper.

The absence of overlapping in the hunting-grounds of the great ecological groups into which we are here dividing the birds is rather remarkable. The rifleman, one of the most assiduous of the trunk-searchers, rarely by any chance wanders to the leaves and twigs, which are the beat of a third preventive corps including in its ranks the brown creeper, the whitehead, the yellowhead, and the grey warbler. The close scrutiny of slender swaying terminal twigs necessitates not only a patient assiduity but also an added agility, which shows itself in the beautiful acrobatic performances of the three former species, and in the fluttering movement of the grey warbler in its efforts to take insects from twigs too slender to bear even its tiny weight.

So the grey warbler, in thus taking prey on the wing and even occasionally chasing in the air moths which it has dislodged, affords an easy transition to the next group, which takes its food almost entirely in the air. Here come those expert fly-catchers, the pied and the black fantails, with their familiar habit of sitting alert on a twig, whence they dash after flying insects of various kinds, in the

pursuit of which marvellous aerial evolutions, assisted by the fan-like tail, are gracefully performed, and the clicking of the tiny bristle-fringed mandibles as they snap on the prey is often distinctly audible. Possibly belonging to this class are the kingfisher, the shining cuckoo, and the long-tailed cuckoo, all of which are in the habit of darting on their prey from a position of vantage. Our kingfisher, unlike the English species, lives only to a relatively small extent on fish, the majority of his food consisting of insects. The morepork, too, takes the whole bush as his hunting-ground and pounces on his prey—here again mostly insects from the air.

To sum up the activities of the insect-eating birds we have divided them according to their feeding-haunts into four main groups, comprising those which exploit the resources of the forest-floor, those which subject the trunks and boughs to a searching scrutiny, those which hunt in the twigs and leaves for their prey, and finally those birds which from a point of vantage take the whole of the surroundings into their purview and either chase their prey in the air or pounce upon it elsewhere.

CONCLUSION.

The whole subject of the relation of birds to the forest is so vast that the writers, in leaving it here, feel that they have given but a sketchy outline. It is hoped, however, that sufficient evidence has been brought forward to indicate at least that the influence of the forest-birds is predominantly good, and, indeed, that a bird in the bush is worth two in the hand!

REGISTRATION OF APIARIES.

In compliance with the regulations under the Apiaries Amendment Act, 1913, as to the registration of apiaries, every person keeping one or more hives of bees is required to make application to register same during the month of June, 1923. Applications will be received by the Director of the Horticulture Division, Department of Agriculture, Wellington. Registration is free of charge; the penalty for non-registration is a fine not exceeding £5.

Beekeepers are requested to note that this year provision has been made on the registration card for a declaration as to the quantity of honey and beeswax produced during the season ending 31st May, 1923. This information is being sought through the Department by the Government Statistician, under the Census and Statistics Act, 1910. In the circumstances beekeepers should appreciate the need of prompt and accurate returns being rendered as early as possible after 1st June.

Cards of application for registration are being forwarded to all beekeepers on the Department's register, but should any person requiring same not receive a card he should make immediate application for one. The cards will be obtainable from the principal district offices of the Department of Agriculture or from the Director of the Horticulture Division, Wellington, or from any of the larger post-offices throughout the Dominion.

Correction.—In the list of Jersey C.O.R. bulls printed on page 202 of last month's *Journal* Sultan's Disdain was credited with 12 C.O.R. daughters—3 qualifying during 1922. The figures should have been 14 and 5 respectively. Consequentially the aggregate of certificated daughters of Jersey C.O.R. bulls is raised from 768 to 770.

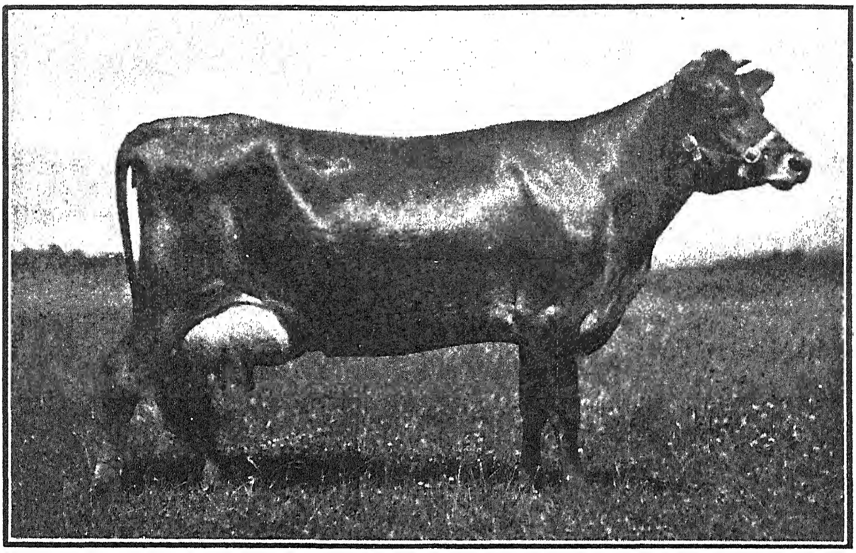
TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR MARCH AND APRIL.

Dairy Division.

THE following list comprises the records of cows which received certificates during March and April, 1923:—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Mercedes Lady Viola	H. C. Sampson, Hillsborough	2 78	248·3	365	9,670·3	524·63
Holly Oak's Jewel ..	John Hale, New Plymouth	2 49	245·4	361	7,680·3	494·44
Snow View Snowdrift	T. W. Perger, Waitara	1 248	240·5	314	6,408·0	424·68
Melissa of the Cliffs..	Mrs. A. E. T. Rhodes, Timaru	1 308	240·5	364	6,867·0	348·53
Bridge View's Molly	F. Hoskin, Matapu ..	2 19	242·4	279	5,965·5	319·99
Springbank Joy ..	E. S. Holdaway, Ballance	2 22	242·7	292	4,783·6	286·03
Top's Beauty ..	H. J. Burrell, Bunnythorpe	1 323	240·5	183	5,468·3	283·04
Hope of Bulls ..	F. J. Watson, Bull's	1 360	240·5	338	4,947·1	241·36
Senior Two-year-old.						
Holly Oak's Beauty	John Hale, New Plymouth	2 165	257·0	357	8,292·3	589·77
Dulciphone ..	A. J. Hale, Hillsborough	2 192	259·7	365	10,071·1	504·96
Three-year-old.						
Delilah	J. Nicholson, Manakau	3 126	289·6	365	10,916·3	641·19
Waipiko Joan ..	C. G. C. Dermer, Waipiko	3 311	308·1	365	10,159·3	535·42
Four-year-old.						
Petunia	F. Hoskin, Matapu ..	4 252	338·7	310	7,730·9	381·42
Mature.						
Luciana of Willow Bank	J. S. Jones, Bell Block	5 123	350·0	365	11,120·5	666·02
Miro Meadow's Queen	A. A. Ward, Tariki ..	7 66	350·0	365	9,860·6	608·92
Spec's Lassie ..	A. J. Harris, Bombay	5 219	350·0	321	10,402·8	580·66
Queen's Bess ..	F. Hoskin, Matapu ..	8 351	350·0	365	11,262·3	542·13
Waipiko Dawn ..	Oscar Monrad, Palmerston North	9 41	350·0	365	10,461·6	541·38
Fairview	F. I. Washbourn, Timaru	10 329	350·0	365	10,699·6	412·79
	FRIESIANS.					
Junior Two-year-old.						
Rosevale Catrina Posch	H. North and Sons, Omimi	2 8	241·3	365	19,641·5	592·18
Rosevale Burkeyje Catrina	H. North and Sons, Omimi	2 44	244·9	365	15,627·9	566·52
Rosevale Princessje	H. North and Sons, Omimi	2 30	243·5	364	13,116·8	471·24
Maidstone Karo ..	John Fisher, Cambridge	2 90	249·5	365	6,926·6	249·98
Ashlynn 94th ..	R. Marr, East Tamaki	1 203	240·5	283	6,929·9	246·69



LADY QUICKSTEP (MRS. M. A. GADSBY, STRATFORD).

C.O.R., Jersey mature class (10 years 30 days): 10,499·4 lb. milk, 701·30 lb. butterfat, in 365 days.

MATANGI QUALITY 4TH (RANSTEAD BROS., MATANGI).

C.O.R., Milking Shorthorn two-year-old class: 14,572·8 lb. milk, 591·89 lb. butterfat, in 365 days.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS—*continued.*						
Junior Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Rosevale Sylvia Colantha	H. North and Sons, Omimi	3 126	289·6	365	20,273·1	716·62
Cordyline Peace ..	George Aitchison, Kaitangata	3 56	282·6	365	15,585·0	616·50
Dutch Cadilac Queen	W. I. Lovelock, Palmerston North	3 54	282·4	365	14,956·3	520·14
Guineaslea Queen ..	L. R. Stoddart, Willowby	3 6	277·6	365	14,910·3	511·21
Junior Four-year-old.						
RosevaleBeautyPosch	H. North and Sons, Omimi	4 61	319·6	365	23,942·1	806·03
Rosevale Queen Daphne	H. North and Sons, Omimi	4 173	330·8	365	20,050·3	805·54
Rosevale Nancy Posch	H. North and Sons, Omimi	4 110	324·5	365	21,652·2	716·35
Ellesmere Grace ..	D. Dickie, Wellington	4 62	319·7	365	17,371·9	625·34
Fairview Netherland Queen	Mrs. T. E. F. Hardwick, Kennington	4 63	319·8	365	16,237·1	545·01
Te Aroha Tulip ..	F. O. Stack, Kiwitea..	4 102	323·7	365	10,973·2	498·38
Lakeview Nazline Kroons	Bloomfield Farm Company, Wellington	4 79	321·4	365	15,390·4	455·32
Senior Four-year-old.						
Princess Van Friesland Park	A. S. Elworthy, Timaru	4 268	340·3	365	17,868·6	592·45
Mature.						
Belle of Friesland ..	C. H. Steadman, Kamo	9 40	350·0	365	21,519·4	822·67
Nazli Segis de Kol ..	G. A. Marchant and Sons, Cardiff	5 203	350·0	365	14,974·8	576·25
MILKING SHORTHORNS.						
Two-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Pine Farm Jewel 4th	J. Parkinson, Opotiki	2 136	254·1	365	12,163·9	472·34

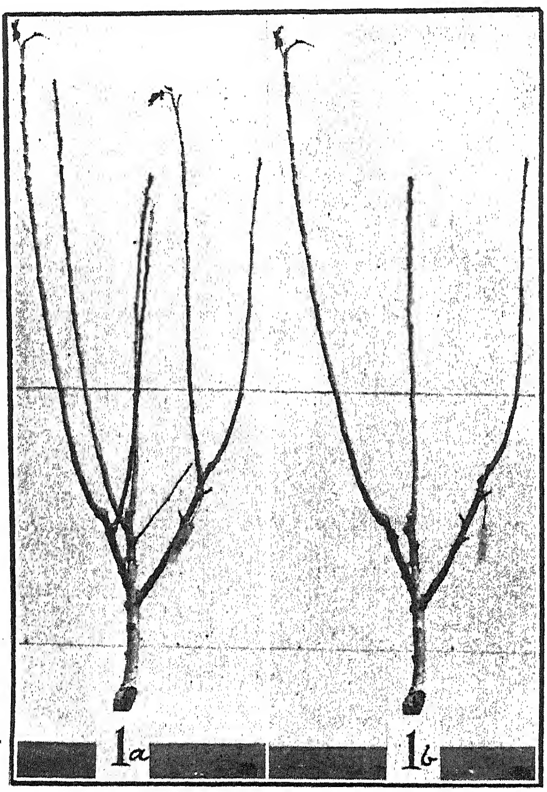
Second-class Certificates.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.						
Marmion of Rosy Creek	E. Joyce, Kaponga ..	2 60	246·5	365	10,893·3	500·53
Waimana's Golden Gipsy	A. Buchanan, Palmerston North	1 314	240·5	365	5,412·4	305·87
Tawa	A. W. Clow, Birkenhead	2 69	247·4	365	4,944·3	298·95
FRIESIANS.						
Junior Two-year-old.						
Longbeach Clematis	J. H. Grigg, Longbeach	2 0	240·5	365	15,841·0	700·42
Oaklea Princess Netherland	S. Knight and Sons, Ongarue	1 104	240·5	365	10,767·9	360·84
AYRSHIRE.						
Two-year-old.						
Glencairn Kate ..	A. Montgomerie, Kauwhata	2 339	274·4	365	12,140·3	573·48

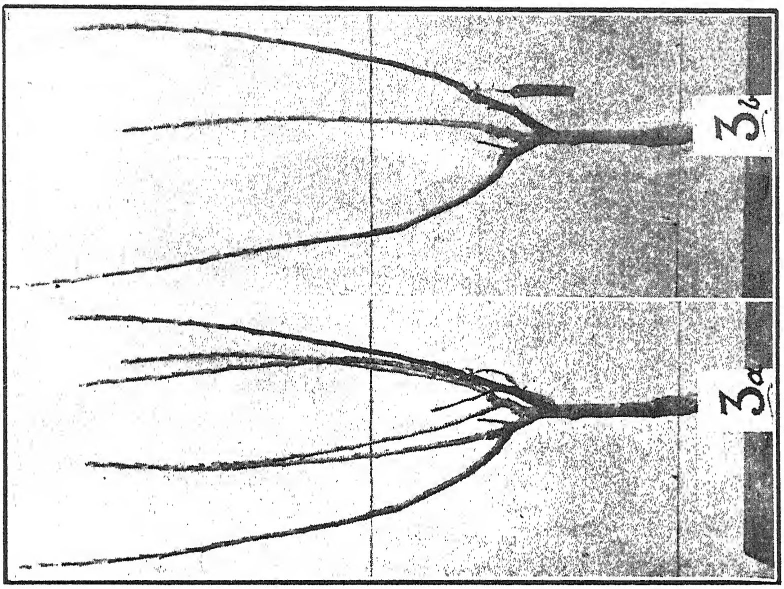
PRUNING YOUNG APPLE-TREES FOR BALANCE.

Horticulture Division.

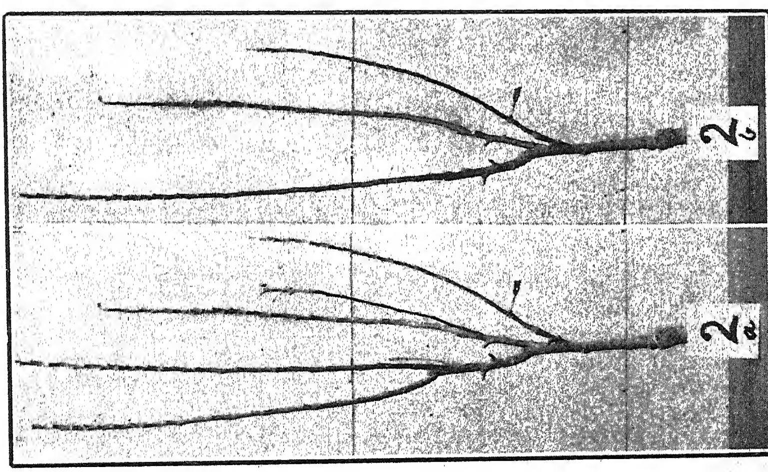
THERE is some diversity of opinion as to the best pruning for a young apple-tree when one of the main arms is much weaker than the others. In order to test the matter an experiment was carried out at Arataki with three young Sturmer apple-trees. The results are demonstrated by the accompanying photographs. Each tree had three arms, two strong and one weak, the latter being identified in each case by a tag. In Fig. 1*a* the weak arm was so pruned as to leave it 5 in. higher than the other two, and the tree is seen as it appeared before the second winter pruning. Fig. 1*b* shows the same tree with surplus growths cut away. The arms left have not been shortened, so that the growth made by each arm may be clearly seen. These general remarks apply also to the other two trees. In Fig. 2*a* the weak shoot was cut hard back, only 2 in. of its length being left, and the strongest arm was left about 10 in. higher than the weak one. The photo shows the subsequent season's growth. Fig. 2*b* shows the same tree after removal of surplus shoots. In Fig. 3*a* the weak arm was left 6 in. long, and the strongest 2 in., the growth made being seen. Here, again, the same tree with surplus growths removed is shown in Fig. 3*b*. It will be seen that the two trees on which the weak arms were left longer than the strong arms are now well-balanced trees, and that the tree on which the weak arm was cut hard back is still badly balanced. The experiment was extremely interesting, and is recorded with a view to bringing the matter to the notice of those who wish to investigate the question further.



1a 1b



PRUNING YOUNG APPLE-TREES FOR BALANCE.
(See text on opposite page.)



SEASONAL NOTES.

THE FARM.

CULTURAL OPERATIONS.

Any remaining stubble or other vacant land intended for crops next season should be turned over, care being taken, however, not to work heavy soils if too damp. If required, early-fed turnip breaks may be ploughed or disked at once, and sown either in oats or barley for spring feeding. A seeding of 3 bushels per acre, using 1½ cwt. of superphosphate, is suitable for average conditions.

In the grain-growing districts the last of the winter wheat should be sown not later than June. The importance and advantage of using pure seed require further stressing. Lincoln College is now supplying pure strains of Pearl and College Hunters at only 3d. above the price of ordinary seed-wheat. Growers may be recommended to obtain their supplies from the College in the first place, and then rogue sufficient of the crop each year to ensure a supply of good seed for their own use at least.

MANGOLD PULLING AND STORING.

Although mangolds may be left in the ground until July or August, they should for preference be pulled in June and allowed to ripen. As well known, freshly pulled mangolds are a dangerous food, especially for dairy cows, and they should always be pulled from four to eight weeks before feeding. The longer they are stored the better the feeding-quality.

When the roots are lifted they should be carted from the field and stacked in a dry situation convenient for feeding-out. In the colder districts subject to heavy frosts they should be covered with straw or fern and earth to prevent them from frosting. Where this is done the top of the clump should be left open for a time to allow the escape of any vapour that may collect from heating. In the warmer parts of the North Island mangolds will keep quite well stacked without covering, especially if placed under the shelter of trees such as pines. It is the first few days after pulling that the mangold is most subject to frost, and where there is a danger of this and the crop cannot be carted away at once the roots should be thrown into small heaps and covered by their leaves until the skin has toughened. Mangolds are sometimes stacked leaves and all, but this practice cannot be recommended. It is better to twist the tops off than to cut them off, as the root bleeds more or less when cut and does not keep so well.

Where mangolds are grown in larger areas and the labour of stacking is prohibitive they may be harrowed out by chain or tine harrows and allowed to lie in the field until required.

IRRIGATION FARMING.

In Central Otago the chief work apart from ploughing will be that of running contour ditches to those parts of the paddocks which could not be properly irrigated during the past season. As the subsoils of Central Otago do not differ very materially from the surface, deep ploughing should be resorted to. The reason why the surface soil does not differ much from the subsoil may be explained from the fact that the fine particles are not moved downward to any extent by percolating water. An arid subsoil as a rule does not possess the raw or unproductive nature that characterizes the subsoil of a district such as Southland, which must be weathered after deep ploughing and before the crop is sown. In Central Otago therefore, with very few exceptions, deep ploughing may be done without detriment immediately prior to the sowing of the crop ; in fact, such practice is of great benefit, because it allows deeper root-penetration and greater retention of moisture. In the process of levelling portions of the land on Galloway Irrigation Experimental Area the soil was sometimes removed to a depth of several feet without injurious effect on the crop which followed.

In certain parts of Central Otago only a light layer of mica-schist soil exists, the subsoil being more or less pure gravel. It would, of course, be folly to plough this type of land deeply or to use it for cropping purposes. The best method of dealing with this type is to skim-plough and get it sown down in some such permanent crop as lucerne or grass. The ploughing-in of green crops of clover and the like will also be of assistance in giving body and depth to light soils, and every irrigator should endeavour to build up the poorer types of soil in this manner.

FEEDING OF ROOTS.

When roots are being fed out to stock an ample supply of hay or chaff should also be provided. As far as possible feeding-out should be done on fields where the pasture is becoming weak or where the grass-grub has been troublesome. By this means seed from the hay is tramped in, while the consolidation improves the pasture and helps materially in ridding the ground of the grub. If oaten hay or hay containing very little seed is being fed out it is a good plan to scatter some clover or grass-seed over the land being fed on, but this should not be done until August or later.

Carrots may be left in the ground until required. Unlike mangolds, they can be fed straight from the field at any time.

In feeding off turnips with sheep, breaks of an area to last the mob about twelve days should be aimed at. Where a good deal of rot is showing in swedes the crop should be fed off as quickly as possible, so as to make the best of it.

CARE OF THE EWE FLOCK.

During the period of gestation, when the ewes require extra food, a field of turnips is of great value. When frost is on the turnips, however, the sheep should not be turned on to the crop until the frost has thawed. They can be left there during the day, but should be taken off before sunset and returned to a grass-paddock where hay in racks is also available. The hay helps to take the chill off the turnips, and the grass acts as a laxative.

The daily shifting to the turnip-paddock and back is very beneficial to the ewes; it helps to keep them in good order generally, and the exercise assists greatly in preventing eversion of the vagina. This trouble, which is liable to occur a few days prior to lambing, is most marked in seasons when feed is too plentiful and the ewes do not have to move far for it, taking little exercise and lying down a great deal. Another advantage in shifting the sheep daily is that they become accustomed to one's presence and easier to handle, which may be very useful at lambing-time.

GENERAL.

More time will now be available for odd jobs. One of the first should be the draining of any boggy places likely to trap weak stock in the spring. Creek-crossings should also be seen to. Hedge-trimming may be undertaken. The repairing of fences and equipment, and the hundred-and-one things always calling for attention on the average farm, will fill in all available time.

Tree-planting for shelter purposes and general improvement of the countryside is important work which can be commenced in June.

POULTRY-KEEPING.

CARE OF THE PULLETS.

JUNE is almost always one of the coldest months of the year. It is therefore imperative that the pullets be given the best possible attention to enable them to produce. The diet at the present time should be carefully studied. In the first place the food should be of the right quality—food capable, after the bodily wants of the bird have been supplied, of going to the manufacture of eggs. It is impossible to get something from nothing, and the scientist has yet failed to discover just how much a hen needs to nourish her body or to manufacture her almost daily egg-product. The only safe course where the high-typed layer is concerned is to give her as much as she can eat without waste. While the food should be ample it should be also of a nourishing nature, in order that the bird be maintained in vigorous health and enabled to stand the great drain on her system which heavy egg-production entails.

Of late I have frequently been called upon to advise poultrymen in regard to the failure of their pullets commencing to lay when expected. On reaching the scene of the trouble I have always found either that the starvation process has been at work, or that the food supplied did not contain sufficient nutriment even to maintain the birds in proper health, much less to enable them to produce eggs. It must be admitted that pullets generally are slow in commencing to lay this season. This is no doubt chiefly due to the unfavourable weather conditions experienced; but it will not help matters by reducing or placing the birds on an inferior ration. An example of the benefit of giving the laying-birds an ample and nourishing ration is frequently provided in the case of hens mothering chickens. These hens will come on to lay even before the chickens are ready to leave them, and probably lay better than any member of the flock. The reason is not far to seek. They have been frequently and liberally fed owing to the attention given to the chickens with them, and thus, having assimilated something more than is required for bodily maintenance, their egg-producing functions have been stimulated and laying naturally ensues.

Giving laying-fowls all they will eat does not mean giving them a liberal ration at one meal and a spare ration at another; it means liberal and regular feeding. Plenty of sound grain food, green material, and meat food are necessary for the production of winter eggs, while sharp gravel-grit, crushed oyster-shell, and clean water should be always available to the birds. Where boiled meat is not available meat-meal should be judiciously supplied in the morning mash, but it should also be available for the birds to pick at it in a separate receptacle. Above all, the general plan of feeding should not be changed—the more uniform the feeding of the bird the better. Change of food and environment are two common causes of pullets going into a false moult, which means at times heavy losses to the poultry-keeper.

It should always be remembered that winter eggs are an artificial, out-of-season product. Obviously the more congenial the surroundings the better chance the bird has of laying to the best advantage. Thus comfortable, clean houses that are free from vermin, and the provision of good dusting-places, are just as necessary as proper feeding.

THE BREEDING-HENS.

When dealing with the hens that are to be used for next season's breeding operations every care should be taken to bring them to a proper condition at the time of mating. Upon the treatment a hen receives now will largely depend her success as a breeder. It is obvious that unless she is in perfect "nick"—her constitution unimpaired and her blood in perfect order—she will not be able to lay eggs containing the desired strength of germ to produce healthy, vigorous progeny. The breeding-hens should be well fed, but they should be handled in such a way that they will not get too fat. Where possible it is advisable to give them their liberty so that they may secure plenty of natural food, and in addition take natural exercise. Confinement, indeed, is bad for all classes of poultry, except, of course, birds being prepared for the table. This treatment should not be confused with the management of the heavy layer in the cold months of the year, when to obtain the best results the layers should be confined in a spacious open-front house on cold, wet, and windy days.

While it is true that the high-type layer cannot be overfed on a proper egg-producing food, it is possible to make a bird overfat when she is on a diet such as that desirable for the intended breeder, in which there is only a small amount of forcing ingredient. From now onward and right through the breeding season it will generally be found that better fertility and stronger stock is obtained by feeding a variety of grains to the breeders night and morning—no mash food whatever to be supplied. Of course, the grain should be fed in a manner that will induce a maximum amount of exercise, such as by throwing it in a deep litter and making the birds scratch for it. Another means of maintaining the breeding-bird in good condition is to keep it well supplied with green material.

It is safe to say that half the troubles met with in the hatching and rearing of stock could be traced to improper management of the parent stock. Probably the chief weakness would be found in allowing the female stock to get into an overfat condition either before or when mated. For any purpose for which fowls are kept I believe in feeding them well, but in the case of birds intended for breeding it may be necessary at times to depart from this rule. Where the birds

are putting on much surplus fat it will probably be found a wise course to slightly reduce the ration, in order that they may be maintained in a more or less lean, active condition—a state which is essential for best results. On the other hand, as before mentioned, in feeding a laying flock it is always better to give a little too much than too little food.

—*F. C. Brown, Chief Poultry Instructor.*

THE ORCHARD.

CONFERENCE-TIME.

THE Provincial and Dominion conferences will now be occupying a good deal of the fruitgrower's time. While performances may fall short of ideals, most thoughtful growers appreciate the progress made as a result of these gatherings. They form a proper and constitutional opportunity for the ventilation of grievances and difficulties, and quite an imposing list of benefits to the industry can be listed as a result, while the educational and social advantages are by no means unimportant. A much larger measure of success will be attained if each grower gives the remits careful consideration and afterwards attends these meetings. There will be a richer harvest of well-thought-out opinions and suggestions that will include the welfare of the trade in general with that of the individual.

PRUNING.

It will soon be time to think of orchard pruning—the most important operation of the winter months. The pruning of fruit-trees, bushes, and plants is a big subject. It may be useful here to draw attention to some of the common mistakes and more recent improvements.

Dealing with stone-fruit first, a vast improvement in the growing of peach and nectarine trees is very noticeable generally. The bare forks and branches that used to be so conspicuous in these trees are now hidden by useful foliage and fruitful laterals, and the best types bear all over from the ground to the tops. This has been brought about chiefly by keeping the framework of the tree open and admitting the sunlight, at the same time giving careful attention to the fruiting-laterals by keeping them well spaced and paying attention to renewals. The old method of cutting leading growth back severely to force out laterals has been replaced by moderate pruning-back of the leader and maintaining good lateral growth by cutting back weak and old laterals to base buds, thus renewing them. This treatment gives a tree with open tops and well-furnished base, entirely different to the crowded tops and bare base of the old type.

A somewhat similar change has been made in the pruning of apricots. This vigorous subject was found difficult to keep within bounds, and by many the crude method of cutting it down to the desired height was adopted. The result, during the following summer, was a heavy crop of young wood that badly shaded the base of the tree and quickly threw it out of profit by destroying the laterals. Such illogical methods are quickly becoming superseded now. The hard pruning necessary in the early stages of the growth of the tree is gradually relaxed as maturity approaches, and the tree comes into bearing earlier—the most effective break of all on vigorous growth. This too gives the desirable open tops, while the fruiting-laterals furnishing the framework of the trees are kept strong and fruitful by careful thinning and shortening them to wood-buds. Wonderful changes can be gradually brought about by adopting these newer methods with stone-fruit trees.

Owing to the susceptibility of this class of trees to bad attacks of many kinds of fungus it is necessary without delay to carefully dress all large wounds with tar.

The problem of handling the prunings in a large orchard is sometimes very considerable. A good method of disposing of them is by means of a fire-cart—an iron tank with perforated bottom, mounted on three low wheels and with a pair of long shafts. This is driven through the orchard after pruning is completed, and the prunings burnt as gathered and dropped again as ashes.

GENERAL.

Continue the preparation of land for planting. Should trees arrive from the nurseryman at an unsuitable time for immediate planting, heel them in carefully in the ground without delay. Too often poor results are due to the roots being allowed to dry out.

Keep in close touch with developments in the fruit store, and continue to ventilate freely. —*W. C. Hyde, Orchard Instructor, Nelson.*

CITRUS FRUITS.

Apart from the usual monthly procedure of picking off such fruits as have reached maturity, there is little to be done at this season of the year in the citrus-orchards. However, where young trees up to three and four years planted are in situations subject to damage from frosts, it is advisable to afford as much protection as possible by means of scrim or sacking covering placed over the trees as soon as the frosty weather makes its appearance.

—*J. W. Collard, Orchard Instructor, Auckland.*

THE APIARY.

WINTERING OF BEES.

THE New Zealand climate being comparatively mild, the successful wintering of bees in any part of the Dominion does not present any great difficulties. As, however, the mildness of the climate tends to make the average beekeeper careless in this regard, reiteration of some of the essentials to successful wintering seems desirable.

Some districts are favoured with winter flowering nectar and pollen-yielding shrubs. Losing sight of the fact that weather conditions during the winter seldom permit of the bees availing themselves of these sources of supply, many bee-keepers trust in a measure to the bees securing some nectar from them, and leave the colonies correspondingly light in stores. The result of this policy is the stoppage of brood-rearing at the most critical time. It is very essential that the bees should go into winter quarters with the largest possible number of young bees. To ensure this brood-rearing must be kept up as long as possible; and to secure this ample stores are necessary.

Young queens are another essential. Old queens will ease off in their egg-laying much earlier than young queens, especially if the old queen has been laying heavily and continuously right through the spring and summer.

Every effort should be made to preserve the warmth of the cluster. A good sound hive must be provided, free from large cracks or joints. The entrance should be reduced to 3 in. or 4 in. in width and not more than $\frac{5}{16}$ in. in depth. If the colony is very weak the entrance should be reduced even more. Bees do not require any ventilation during the winter months other than provided by the entrance. If the entrance is more than $\frac{5}{16}$ in. deep mice will enter when the bees are dormant, and damage the comb and eat the honey.

Needless to say, a good roof is essential, but as it is the most difficult to make it often receives the least consideration. The flat telescopic roof is generally considered to be the best. In making this type of roof the outside framework is first required. This should be made of 1 in. timber, double-dressed, and preferably totara or some equally durable timber. The inside dimensions of the frame should be $\frac{1}{2}$ in. longer and $\frac{1}{2}$ in. wider than the outside measurements of the hive-body, and $1\frac{1}{2}$ in. deep. While the roof is less likely to blow off if telescoping 2 in. or 3 in., it is found that the wider framework is liable to warp with the sun. The frame when nailed together at the corners should be squared and then covered with $\frac{1}{2}$ in. timber—the sides of benzine-cases answer the purpose. The parts of the frame that will be exposed to the weather should now receive three coats of paint. The best covering is No. 28 gauge galvanized iron. This should be cut 3 in. longer and 3 in. wider than the outside dimensions of the frame, to allow of its being bent over $1\frac{1}{2}$ in. approximately, on either side and end.

To accomplish this place the iron on the floor and the roof in position in the centre; hold the roof in position by standing or kneeling upon it, and beat the iron into position with a hammer or mallet, securing it with ⅝ in. clout nails along the side. A cheaper roof may be constructed by substituting ruberoid for the galvanized iron, but the difference in cost is negligible: the iron-covered roof will last much longer and be cheaper in the end.

Quietude is another essential to successful wintering. In districts where the bees do not fly freely during the winter or the cluster does not thaw readily under the influence of a few puffs of smoke the bees should not be disturbed. Bees naturally gorge themselves with honey when disturbed. This is followed by a corresponding necessity to void the excreta, which the bee accomplishes while flying. If weather conditions make it necessary for them to retain this impurity for a number of days it tends to undermine their constitution and induce dysentery.

Given a sound hive (bottom-board and roof) and ample stores, the next concern is to see that the bees occupy a sunny position sheltered as much as possible from the prevailing wind, and high enough from the ground to escape the dampness arising therefrom. If these matters have received full consideration the bees should not require any further attention until the spring.

—*H. W. Gilling, Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

CABBAGES for the earliest spring supply are in many cases already planted; where they are not the plants should be got in wi hout delay. The true earlies make very small heads and require very little space. The rows need not be more than 18 in. apart, with the plants 12 in. apart in the rows. Well-drained land is especially necessary for the early crop; if the soil holds water it will be cold and progress of the plants delayed. Farmyard, stable, or animal manure of any kind should not be used for early crops; it holds water like a sponge and makes the ground cold. A dressing of 2 oz. or 3 oz. of blood-and-bone per square yard may be given, or the same amount of superphosphate with ¾ oz. of sulphate of ammonia added. When the plants begin to grow, a dressing of nitrate of soda, ½ oz. to ¾ oz. per square yard, will hurry them along.

Beds of young turnips should have what attention they require in the way of thinning as early as possible. White-fleshed varieties do not require much thinning. They begin to bulb early, and if they are pulled as soon as ready room is made for others. The yellow-fleshed varieties stand longest; these should be thinned at once to allow space for the development of each root.

A good many people have the idea that summer variety of rhubarb should be lifted in winter and be kept out of the ground till spring. This is quite wrong; it should not be disturbed except for special reasons, but if it is lifted it should not be replanted till spring. This is practiced not because it benefits the rhubarb, but because if it were planted back during winter the soil would become weedy. As the plants remain dormant till spring it is best to delay planting till that time, when the roots can be planted in freshly worked, clean soil.

SMALL-FRUITS.

Strawberries.

Well-drained soil is essential for strawberries, for although the roots do not penetrate far down they are as fine as hairs and perish during winter in soil that holds surplus moisture. Planting practice differs according to climate, and to some extent according to the extent of the planting. In places where a dry spring is usual planting is done in autumn, being usually completed before the end of April, so that the plants may get a hold of the ground before winter. Where a fair amount of rain is usual in spring, planting is best delayed till that time. During winter in normal places the soil grows weeds. The deletion of these from newly planted beds is a formidable task, as much of it must be done

by hand, and in many cases it is an impossible task. In such circumstances it is much better to delay planting till spring, the ground in the meantime being worked as opportunity offers, and surface cultivated immediately before planting. The runners should be secured in autumn and planted in nurse-beds, spacing them 3 in. or 4 in. apart in rows just wide enough apart to allow a flat hoe to pass between them.

The question of variety can be decided only by experiment, as a variety that does well in one place may not be worth growing in another. In the North Early Marguerite, a large berry of poor flavour, is almost the sole variety grown. In the South Laxton's Noble and Melba are the chief varieties cultivated. In middle districts all these varieties are grown, but Trollope's Victoria, now known as "Duke of Edinburgh," an old variety of excellent flavour, is giving most satisfaction.

Where established beds that are to be left for another season are affected with the leaf-spot disease, all the old leaves should be cut off and burned, and the plants sprayed with 4-4-40 bordeaux.

Loganberries.

Commercial plantings of this fruit are increasing, and in the course of the next few years it is likely to reach important dimensions. Planting is best done in spring; remarks on that head can therefore be held over. In commercial plantations, also in some gardens, the rods are tied to wire supports. In that case the bearing-rods are renewed each year. The usual practice is to leave pruning till winter. It is much better to cut the old rods out as soon as the crop is past, the young rods thus getting the benefit of a greater amount of light and air.

Raspberries.

Where extensions of plantations are intended strong young suckers that come up clear of the old stools make the most thrifty plants. A sufficient number of these should be lifted and heeled in for planting later on. When they are planted they should be cut down to about 4 in.

Raspberries are subject to two fungus diseases and a very damaging insect pest—the bud-moth, as well as to leaf-roller caterpillars, which are a minor pest. The cane-wilt disease was the subject of an article by Mr. G. H. Cunningham in the *Journal* for January, 1922. The disease is not at present of frequent occurrence except in one or two districts. The only control measure at present known is to cut out affected parts or the entire plant.

The other fungus disease is raspberry anthracnose, which is attacking plantations in a number of places in both Islands. This disease can be controlled, very satisfactory results having been secured by following instructions given by the Department. One of the necessary measures is to remove the old canes as soon as the crop is past, and to at once spray the new canes with 4-4-40 bordeaux. There is some superficial resemblance between the two diseases; therefore any one having infected plantations is advised to send specimens for identification of the disease. Cases of infection of loganberries by both these diseases have occurred, and the foregoing remarks apply equally to that plant.

The control of bud-moth rests largely on the destruction of the over-wintering grubs. These take shelter in trash about the stools, to some extent in the soil, and also in the hollow stubs of old canes. It is therefore important that the canes should be cut as low as possible, and some soil thrown into the stools to cover the stubs.

—*W. H. Taylor, Horticulturist.*

Cow with Triplets.—A cow belonging to Mrs. E. J. Innes, of Paroa, Greymouth, recently gave birth to three calves—one heifer and two bulls. The heifer was born without a tail, but the calves are all healthy and doing well, as also the mother. Triplets are very unusual among bovines, and it will be of interest to note whether in this case the heifer will breed. In about 80 per cent. of cases of twinning, when the calves are of different sexes, the heifer is a "free-martin"—*i.e.*, sterile.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COWS WITH CONTAGIOUS MAMMITIS.

"COCKY," Tutekehua :—

During this autumn some half-dozen of my cows have had an affection in one quarter of the udder. The first symptom is yellow curdy matter on the milk; then the quarter gradually dries until, after a few days, a quantity of curd comes, in some cases in lumps and in others ropy; finally a little watery matter only is given. The quarter is not hard, but feels just the same as the others. What is the cause and the remedy?

The Live-stock Division :—

Judging by the described symptoms your cows are in all probability affected with contagious mammitis. The cause of this disease is microbial, and it is spread from cow to cow by the milker's hands or the cups of the milking-machine. When such a condition as you describe is noticed in a cow's quarter no time should be lost in forwarding a sample of the secretion to the Officer in Charge, Veterinary Laboratory, Wallaceville, Wellington, who will examine the sample, and send you a report, free of charge. An ounce bottle is quite large enough. This is first sterilized by boiling (also the cork). The secretion is milked straight from the teat into the bottle, which is corked, labelled with number or name of cow, and forwarded, securely packed, to Laboratory. At the same time a letter should be forwarded explaining the nature of the cases. Treatment of contagious mammitis is unsatisfactory, and strict precautions are necessary to prevent its spread. The person milking affected cows must not handle a sound udder without first thoroughly disinfecting the hands (it is preferable to strip diseased cows last). The secretion must not be allowed to fall on the ground, but should be stripped into a kerosene-tin containing sheep-dip or some other strong disinfectant. The best procedure is to dry off and fatten cows affected with contagious mammitis, as it is possible for cows to remain centres of infection, giving rise to fresh cases the following season.

CONTROL OF MEALY BUG.

F. C. P., Gisborne :—

Would you kindly inform me if there is any effective method of getting rid of the mealy bug. It attacked my passion-fruit vines, which were growing on a trellis near the house. Acting on advice from experienced orchardists I cut the passion-fruit down. Unfortunately, the mealy bug has attacked the tomatoes, a white broom, and a chorizema.

The Horticulture Division :—

The control of mealy bug is an exceedingly difficult problem, as it attacks such a great number of different plants and shrubs. This is more particularly the case in the warmer districts, where the climate favours rapid and continuous propagation of the insect. In many cases hedges and shrubs of dense habit are attacked, and with these effectual spraying is a practical impossibility. Where such shrubs are infested they form breeding-grounds that are favourable to the insects, and other subjects are sure to be infested from these sources. Effective control is not likely under such circumstances until a natural enemy has been found, which has not yet been done. Cutting back the passion-vine was the only thing to do; it could not be sprayed. The spray that has shown the best results is red spraying-oil, 1 in 40, for evergreen trees or shrubs. This spray will kill young bugs, but will not affect eggs, therefore several sprayings are

necessary to effect a clearance. This treatment should be effective on the chorizema, which has fairly tough leaves. The broom would stand heavy cutting-back, which would simplify spraying. Apple-trees can be heavily sprayed with red oil, 1 in 8 or 1 in 10, when in a dormant state. Any shrubs that are found to be badly infested should be headed down, the prunings burned, and the headed shrub thoroughly sprayed.

PERENNIAL CANARY-GRASS.

"SUBSCRIBER," Pleasant Point :—

I would like to know if perennial canary-grass could be successfully grown on ridgy land which holds cocksfoot and other permanent grasses fairly well. When established would it be hard to eradicate like twitch, and what would its fattening properties be ? We have fairly hard frosts.

The Agricultural Instruction Service :—

Perennial canary-grass (*Phalaris bulbosa*) is a succulent and palatable grass which grows well during the winter and spring months and stands stocking well. It is not superior to prairie-grass, but it withstands frost very well and gives early spring feed. It is not a twitch, and would not be hard to eradicate. It is a deep fibrous-rooting plant, in most cases vested with a woolly covering, and requires a deep loose soil to give the best return. During the hot summer it makes no growth, and at such a period requires resting. It has been tried in Canterbury at various times but has not become generally popular. About 8 lb. of seed is required to sow 1 acre. The best time to sow would be early autumn, but sowings may be made in early spring.

SCABBY NOSES AMONG LAMBS.

P. BATES, Sen., Alford Forest :—

Will you kindly inform me as to the nature and cure of scabby noses among lambs ?

The Live-stock Division :—

Rough, rank grass, especially of autumn growth, often causes the condition your describe ; lambs depastured on stiff straw stubble also occasionally suffer in this way. The skin becomes broken and outside germs gain entrance, setting up a condition of gangrene which ultimately becomes covered with a dry, hard scab. The treatment recommended is to remove the lambs to a short, sweet pasture, and to dress those affected with a 5-per-cent. solution of one of the standard disinfectants, or with sulphur ointment (1 part of flowers of sulphur to 8 parts of vaseline or lard).

PROTRUSION OF THE OVIDUCT IN FOWLS.

H. SMITH, Kilbirnie :—

Can you tell me the cause of fowls picking each other's vent ? I lost a good pullet through this cause. I noticed that she was being pecked and removed her to another pen, but she was bleeding, and when she tried to get rid of her droppings other parts of her inside came out, causing her to die next day.

The Chief Poultry Instructor :—

The cause of the other members of the flock picking at the vent of this bird was no doubt due in the first place to a hæmorrhage, or to protrusion of the oviduct, or to what might be termed an ovarian disorder. This trouble is generally the result of overfeeding rich foods such as meat, milk, &c., while sometimes it is due to an overfat condition ; this applies particularly where a bird has a weak constitution. Of course, even in the best-managed of flocks an odd case of this kind is apt to occur, but if frequent cases appear the only safe course is to provide a less forcing ration. There is practically no cure for the trouble, and the only safe way of dealing with it is to prevent it.

PITTING POTATOES.

S. F. STEVENS, Takapau :—

Would you kindly inform me as to the proper way to pit potatoes. Is it necessary to place straw in the bottom of the pit for the potatoes to rest on ?

The Agricultural Instruction Service :—

To pit potatoes mark out the ground—space to be used—this should be from 4 ft. to 6 ft. wide—and build the potatoes up as high as they will comfortably sit. Then cover with from 6 in. to 9 in. of straw, and place a few inches of earth over this. If the weather is fine it is best to leave the top of the pit open for a few days to allow any steam to escape that may collect. It is not necessary to place straw below the potatoes. For North Island conditions potatoes are best kept in a dark shed where they can be easily got at should blight develop.

NASAL CATARRH IN SHEEP.

J. M., Auckland :—

A line of sheep I purchased at saleyards suffers from sore eyes, and a thick discharge from the nostrils which nearly blocks the nose and prevents breathing. I would like to know the cause, if the trouble is contagious, and if treatment is necessary.

The Live-stock Division :—

Nasal catarrh in sheep is most commonly caused by the presence in the nasal passages of the animal of the so-called nasal bot of sheep. This is the larvæ form of the sheep nasal fly (*Oestrus ovis*). The fly, in striking the sheep's nose, deposits the eggs, and the developing larvæ eventually reach the nasal cavities and air-spaces of the head. The irritation set up causes a thick discharge from the nostrils. The grub is often seen on post-mortem, when the sheep's head is cut in two. Treatment is not satisfactory. When mature the grub becomes dislodged from the nose.

RAISING PHORMIUM-PLANTS.

"SUBSCRIBER," Khandallah :—

I have saved a considerable quantity of flax (phormium) seed, and wish to raise plants for a breakwind. Should I sow *in situ* or sow in a seed-bed and plant out; when should I sow ; and what other points should be observed ?

The Horticulture Division :—

The seeds should be sown in boxes or in beds ; it is not practicable to sow *in situ*. Sowing in boxes is an advantage late in the season, as they can be protected from heavy rain. In the ground the seeds may be sown as though they were parsnip-seeds. As soon as the young plants can be handled they should be transplanted into lines in the open ground, spacing them about 6 in. apart in rows wide enough to hoe between. The plants will be ready for final planting in the spring of the following year. If the seeds are sown soon after being collected the young plants will appear inside of three weeks ; if kept till spring they will be twice as long.

Winter Farm Schools.—A course for farmers, organized by the Westland branch of the Canterbury Progress League, will be held at Hokitika from 25th to 29th June. The lecturers will include several officers of the Department of Agriculture. In regard to the Ruakura Farm School, announced, together with others, in last month's *Journal*, applications for enrolment should be made to the Instructor in Agriculture, Department of Agriculture, Auckland—not to the Farm Manager as previously stated.

NEW ZEALAND INSTITUTE OF HORTICULTURE.*

CONSTITUTION AND RULES.

1. The name of the Institute shall be "The New Zealand Institute of Horticulture (Incorporated)."

The registered office of the Institute shall be in the City of Wellington, or in such other place in the Dominion as the executive of the Institute shall from time to time decide upon.

OBJECTS.

2. The objects of the Institute shall be—

(*a.*) To encourage, foster, and improve every branch of horticulture, ornamental as well as useful.

(*b.*) To exercise all the powers and functions of a horticultural nomenclature and certificating Board, including the making of decisions and reports in regard to the nomenclature of trees and plants, and to issue, in the name of the Institute, certificates, medals, or diplomas for novelties of merit or new varieties.

(*c.*) To assist and promote horticultural education in all branches and in every way possible.

(*d.*) To promote legislation having for its objects the advancement or protection of horticulture in any or all of its branches.

(*e.*) To assist research work in connection with any or all branches of horticulture.

(*f.*) To endow, assist, or support any chair or lectureship in any college, university, or other educational institution the Institute may decide upon.

(*g.*) To promote the interchange of horticultural knowledge and to co-operate with Governments, scientific or other societies or bodies, or persons in any part of the world who may be working along any or all of the lines covered by the objects of this Institute.

(*h.*) To undertake or assist in the introduction and acclimatization of any fruit-tree, flowering tree or plant, forest-tree, seeds, or other form of plant-life which in the opinion of the Institute should be introduced.

(*i.*) To establish, assist, or endow libraries, and to obtain by purchase, exchange, or otherwise books, papers and other publications relating to any or all the matters covered by the objects of the Institute.

(*j.*) To arrange for the carrying-out of work of "bud-selection," the testing of new varieties of trees, plants, vegetables, and any and all things necessary to a better understanding of tree and plant life and the maintenance or improvement of the standard of such, whether originally raised from seed or from vegetable mutation.

(*k.*) To arrange for the selection and breeding of any or all classes of trees and plants for testing, and for the supply of certificated propagating-materials to nurserymen and others on such terms as may be arranged.

MEMBERSHIP.

3. (*a.*) Any person, society, association, firm, company, or other body accepting the objects of the Institute may become a member by subscribing to the funds of the Institute and accepting and complying with the rules thereof.

(*b.*) Honorary members: Persons who have rendered special services to the Institute or who for other reasons are deemed worthy of special recognition may be made honorary members.

(*c.*) Life members: Any person or firm accepting the objects of the Institute and donating in one sum ten pounds ten shillings (£10 10s.) shall upon election by the executive become a life member with all the rights and privileges of a full member of the Institute.

(*d.*) The secretary shall keep a complete and up-to-date roll of members.

4. (*a.*) Any member shall be entitled to withdraw on giving notice of his intention to do so, provided that all moneys payable to the Institute have been fully paid.

* The Institute is being registered under the Incorporated Societies Act, 1908.

(*b.*) Any member failing to pay his annual subscription within twelve months of the due date may be given one month's notice to pay the same, in default of payment of which his membership will be cancelled, and if after the expiry of such notice such annual subscription shall still remain unpaid, then such member's name shall be taken off the roll of members.

ALTERATION TO RULES.

5. The constitution, rules, and definitions of the Institute shall not, unless otherwise stipulated therein, be added to or altered except at the annual meeting of the Dominion Council or at a special meeting called for the purpose. Notice of any proposed alteration or addition to the rules must be forwarded by the secretary of the Dominion Council to each councillor and secretary to the District Councils at least fourteen days before the date of the meeting at which such proposed alteration or addition is considered.

THE DOMINION COUNCIL.

6. (1.) The affairs of the Institute shall be managed by a council termed the Dominion Council, representing the District Councils, and by an Executive Committee, and these bodies shall have power to elect such sub-committees as may be deemed necessary from time to time to assist them in carrying out their duties.

(2.) (*a.*) For the purpose of giving representation to the whole Dominion the country shall from time to time be divided into districts by the executive ; each district shall have a District Council consisting of all members of the Institute within the district, and each council shall set up a district executive.

(*b.*) The Dominion Council shall consist of delegates appointed by the District Councils. Each District Council may appoint one delegate for every hundred members or fraction thereof. The following persons shall also be members of the Dominion Council: (1) Director or Assistant Director of the Horticulture Division of the Department of Agriculture ; (2) the accredited representative of the New Zealand Fruitgrowers' Federation (Limited) ; (3) the accredited representative of the New Zealand Association of Nurserymen (Incorporated) ; (4) the accredited representative of the New Zealand Farmers' Union ; (5) the accredited representative of the horticultural societies that are members of the Institute (until such time as the horticultural societies of the Dominion are controlled by a central governing body the method of electing a representative for such societies must be approved by the executive) ; (6) the accredited representative of the New Zealand Forestry League ; (7) a secretary and treasurer or secretary-treasurer.

Notice of the appointment of a delegate, signed by the secretary of the District Council, must be in the hands of the secretary to the Dominion Council at the date of the annual meeting of the council.

OFFICERS.

7. (*a.*) The officers of the Institute shall be patrons (who shall have no voice in the affairs of the Institute), a president, three vice-presidents, and a secretary and treasurer or a secretary-treasurer. Patrons, president, and vice-presidents may be nominated by any District Council or at the annual meeting of the Dominion Council, and shall be elected at the annual meeting of the Dominion Council, and shall hold office until the first annual meeting of the Dominion Council subsequent to the date of their appointment. The secretary and treasurer or secretary-treasurer shall be elected by the executive, and shall hold office in accordance with conditions prescribed by the executive.

(*b.*) The president of the Dominion Council shall preside at all meetings. In the absence of the president a vice-president shall preside. If none of these officers are present the meeting shall elect a chairman.

(*c.*) Should the office of president or any other office become vacant from any cause, such vacancy shall be filled at the first ensuing executive meeting.

(*d.*) Councillors shall hold office from time of appointment until the appointment of their successors. Should a vacancy occur the executive of the unrepresented District Council or organization shall immediately appoint another representative. Should any District Council or other organization at its annual meeting fail to appoint a representative on the Dominion Council, or to fill within one month of such vacancy any vacancy that may occur, the executive may make the appointment at its first subsequent meeting.

(*e.*) A councillor may be suspended or expelled by a vote of two-thirds of those present at a meeting called for the purpose.

MEETINGS OF DOMINION COUNCIL.

8. (*a.*) The annual meeting of the Dominion Council shall be held not later than 30th June of each year.

(*b.*) Notices of any business for consideration at the annual meeting must be sent to the secretary of the council four weeks before the conference.

(*c.*) The secretary shall give not less than three months' notice of the date fixed for such meeting to each member of the Institute, and shall forward to the secretary of each District Council, at least fourteen days before the annual meeting, the annual report and balance-sheet and a notice of all business which it is proposed to lay before any meeting of the council.

(*d.*) The business of the annual meeting which shall take precedence of all other business shall be to receive report and balance-sheet; to elect officers; to elect an auditor; to consider all business of which one month's notice has been given to the secretary in writing.

(*e.*) A special meeting of the council shall be called by the secretary upon instructions from the Executive Committee, and upon receipt of a requisition setting forth the object of such meeting signed by the secretaries of not less than three District Councils.

(*f.*) At any meeting of the council ten members shall form a quorum.

Voting: The president or chairman of any meeting shall have a deliberative as well as a casting vote. Each councillor shall have one vote only. All resolutions shall be decided by a majority of votes cast by those present who are eligible to vote. Voting shall be recorded on the voices or by a show of hands. Notwithstanding the foregoing, however, a ballot may be demanded, provided that such demand is supported by one-third of the members present.

EXECUTIVE COMMITTEE.

9. (*a.*) The Executive Committee shall consist of seven members, and shall include the secretary and the treasurer to the council. All members of the Executive Committee except the secretary and treasurer shall be appointed by the Dominion Council at the annual meeting, and they shall continue in office until the close of the subsequent annual meeting of the council. The Dominion Council shall have power at any time to increase the Executive Committee to nine.

(*b.*) Five shall constitute a quorum for an executive meeting.

(*c.*) At all meetings of the executive the vote of the majority shall rule, and shall be by ballot if so desired by any member present, and the chairman shall have a deliberative as well as a casting vote.

(*d.*) It shall be the duty of the executive to carry out all the business of the Institute.

CONTROL OF COMMON SEAL.

10. The common seal of the Institute shall be kept in the control of the secretary, and shall be affixed to any document or writing only by resolution of the Executive Committee, by any member of such committee, the secretary, and the treasurer.

CONTROL AND INVESTMENT OF FUNDS.

11. All funds of the Institute shall be paid into the bank, to the credit of the Institute, and all accounts shall be passed by the Executive Committee and paid by cheque signed by the secretary or treasurer and any member of the Executive Committee.

12. With respect to the property and funds of the Institute the following provisions shall have effect:—

(*a.*) The Institute may (if its rules do not direct otherwise) invest the funds of the Institute or any part thereof to any amount in any of the following ways: (1.) In the purchase or lease in its own name of any land or buildings, and may hold, sell, exchange, mortgage, or lease the same upon whatever terms the executive considers to be in the interests of the Institute, and may build upon the same (with power to alter and pull down buildings and again rebuild); and no purchaser, assignee, mortgagee, or tenant shall be bound to inquire as to the authority for any sale, exchange, mortgage, or lease by the Institute; and the receipt of the Institute shall be a discharge for all moneys arising from or in connection with such sale, exchange, mortgage, or lease. (2.) In the Post Office Savings-bank, or in such other bank or banks as the executive may from time to time direct. (3.) In any debentures, bonds, Treasury bills, or inscribed stock issued by or on behalf of the Government under the authority of any Act or by any local authority or Harbour Board.

(b.) In advancing money by the Institute to members on the security of real or personal property.

(c.) The Institute may invest any part of its capital in the shares or on the security of any society registered under the Building Societies Act, 1908, or of any company registered under the Companies Act, 1908, or incorporated by Act or by charter, provided that no such investment shall be made in the shares of any society or company other than one with limited liability.

(d.) Any investment allowed by the Trustee Act, 1908, and its amendments.

(e.) All moneys so invested shall be invested under the Institute's incorporated name, and any receipts for moneys so invested shall be executed by affixing the seal as provided in clause 10.

POWER TO BORROW MONEY.

13. The Institute shall have power to borrow money for the purposes of the Institute upon any of its assets.

DISPOSITION OF PROPERTY OF INSTITUTE IN EVENT OF WINDING UP.

14. In the event of the Institute being wound up, any surplus after the payment of all liabilities and liquidating fees shall be given to some institute or society having similar objects as this Institute.

CAPITAL OF INSTITUTE.

15. The capital of the Institute shall be derived—

(a.) From a subscription of ten shillings (10s.) per annum to be paid by every person who is a member.

(b.) From annual subscriptions from societies, associations, companies, corporations, firms, and other bodies accepting the objects of the Institute and paying an annual subscription of one pound (£1) for every fifty members of such society, but not to exceed five pounds (£5) for any one society. The president, chairman, or head of such society, association, firm, or other body shall be a member of the District Council.

(c.) From special payments for special information required by or privileges granted to members, such sum to be sufficient to reimburse the council for expenses incurred in connection therewith.

(d.) From the Government or other bodies.

(e.) From legacies and endowments.

(f.) From any other source whatever.

FINANCIAL YEAR.

16. The Institute's financial year shall commence on the 1st April in each year, and all members' subscriptions shall be due and payable thereafter.

DISTRICT COUNCILS.

17. The following general rules shall be observed by and in relation to the District Councils of the Institute :—

(a.) All members in any given district shall belong to both the District Council and to the Institute ; membership in one shall constitute membership in the other.

(b.) District Councils shall convene their own meetings, elect their own chairman, vice-chairmen, secretary, treasurer, and such other officers as they shall deem necessary.

(c.) The District Councils shall submit an annual report to the executive, covering all operations for the past year.

(d.) The District Councils may adopt such rules and by-laws as they may deem necessary.

(e.) District Councils may levy dues (subscriptions) on members within their district, provided that such do not exceed 40 per cent. of the annual dues levied by the Institute.

(f.) District Councils may, with the consent of the executive, raise funds within their respective districts for any special object or objects.

(g.) All actions and decisions of District Councils may at any time be reviewed, and if deemed by the executive to be an infringement of or antagonistic to the rules of the Institute may be altered, revised, or disallowed, as the case may be. Any District Council not satisfied with the decision of the executive may at the next annual meeting appeal to the Dominion Council for a ruling.

WEATHER RECORDS: APRIL, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE rainfall for the month of April was, generally speaking, above the average for the month in all the east-coast districts, but below the mean in Taranaki and west-coast districts of the South Island. These results were accounted for by ex-tropical disturbances, which brought heavy downpours in various districts. Thus on a single day in more than one place the quantity that fell was almost double the mean for the whole month in previous years. At Hamilton the maximum for one day was 5·12 in., at Tairua (Thames) 4·56 in., and at Tauranga 9·41 in., forming in great part the totals for the whole month. An amount of 4·19 in. fell in three days at Auckland. This heavy fall was accounted for by an ex-tropical storm, with easterly gales, which arrived on the 18th and passed in the north on the 22nd. While this occurred a "secondary" appears to have developed in the south, and one of the most serious floods on record in Dunedin took place. Rain commenced on Saturday night (21st) and continued for about thirty-six hours; 1·21 in. were credited to the 20th by the Dunedin observer, 6·81 in. to the 21st, and 0·43 in. to the 22nd, making a total of 8·45 in. for the three days.

The remarkable feature about these downpours in the northern and southern districts is that places between did not experience them. Thus the totals at places in the vicinity of Cook Strait are below the mean for the month. The west coast of the South Island recorded from 70 to 80 per cent. below the usual. The high lands of the South Island also do not show the average quantity of rain for April. Thus while Dunedin had almost four times the average, Queenstown, practically in the same latitude, was 45 per cent below the mean, while farther south, Invercargill had a deficiency of 17 per cent.

RAINFALL FOR APRIL 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	4·04	11	0·90	3·55
Russell	5·36	12	1·82	3·39
Auckland	5·00	10	2·34	3·33
Hamilton	7·01	10	5·12	3·64
Kawhia	5·42	10	3·06	4·75
New Plymouth	3·28	9	1·19	4·57
Inglewood	3·02	12	0·74	8·54
Whangamomona	3·08	11	1·38	6·68
Tairua, Thames	7·82	10	4·56	5·88
Tauranga	12·54	10	9·41	4·55
Maraehako Station (Opotiki)	7.00	9	3·24	5·22
Gisborne	6·72	12	2·58	4·26
Taupo	3·04	7	1·70	3·95
Maraekakaho Station, Hastings	3·15	11	1·13	3·54
Taihape	2·49	14	0·92	3·37
Masterton	2·67	13	0·46	3·18
Patea	2·77	8	1·27	3·95
Wanganui	1·47	3	0·95	3·59
Foxton	1·15	4	0·35	2·70
Wellington	3·08	12	0·88	3·92

RAINFALL FOR APRIL, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
	South Island.			
	Inches.		Inches.	Inches.
Westport	1·24	7	0·40	6·50
Greymouth	1·90	6	0·64	8·83
Hokitika	2·18	9	0·74	9·20
Arthur's Pass	2·11	4	0·95	17·64
Okuru, Westland	3·30	6	1·32	13·67
Collingwood	2·42	8	0·59	8·07
Nelson	1·16	4	0·62	2·98
Spring Creek, Blenheim ..	1·39	5	0·48	1·91
Tophouse	1·01	4	0·52	4·03
Hanmer Springs	2·01	4	0·80	3·27
Waiau	2·00	8	0·70	1·75
Gore Bay	2·74	10	0·79	2·02
Christchurch	2·94	13	0·90	1·91
Timaru	2·22	12	0·84	1·49
Lambrook Station, Fairlie ..	1·36	5	0·66	2·00
Benmore Station, Omarama ..	1·78	7	0·76	2·52
Oamaru	4·91	7	4·26	1·76
Queenstown	1·95	4	0·78	2·92
Clyde	2·19	4	1·80	1·34
Dunedin	10·60	12	6·81	2·72
Gore	3·83	13	1·80	3·26
Invercargill	3·62	18	1·38	4·37

Correction: The total fall for March at Kawhia was 3·12 in., with fourteen wet days.

IMPORTATION OF FERTILIZERS, MARCH QUARTER.

FOLLOWING were the importations of fertilizers into New Zealand for the quarter ended 31st March, 1923:—*Sulphate of Ammonia:* Netherlands, 50 tons; United States, 205 tons. *Gypsum:* United Kingdom, 2 tons; Australia, 61 tons. *Nitrate of Soda:* United Kingdom, 25 tons; Chile, 65 tons. *Basic Slag and Thomas Phosphate:* United Kingdom, 1,381 tons; Belgium, 1,300 tons; United States, 1,000 tons. *Bonedust:* India, 175 tons; Australia, 555 tons. *Guano:* New Caledonia, 3,279 tons. *Rock Phosphate:* Nauru Island, 12,286 tons; Ocean Island, 7,319 tons. *Kainit:* United Kingdom; 75 tons; Belgium, 175 tons; France, 400 tons; Germany, 310 tons. *Muriate of Potash:* France, 10 tons. *Sulphate of Potash:* United Kingdom, 35 tons; Belgium, 25 tons; France, 40 tons; Germany, 60 tons. *Potash, other:* United Kingdom, 20 tons; France, 50 tons; Germany, 225 tons. *Sulphate of Iron:* United Kingdom, 5 tons. *Fertilizers, other:* United Kingdom, 1 ton.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 5th May: *Peas*—Market firmer; parcels of New Zealand Maple afloat have been resold for 85s. to 90s. per quarter, c.i.f.; 110s. ex store has been asked for shipments which have arrived, but no business reported. Tasmanian resale offered at 120s. ex store. Blue peas in slow demand and no business passing. Japanese green peas, May-June shipments, sold at 23s. 6d. per hundredweight. September-October shipments, 23s. *Beans*—Market quiet for imported. Chinese horse, spot, sold at 12s. per hundredweight; July-September shipments, 10s. 6d. English market quiet but steady at 9s. 6d. to 11s. New Zealand spot quoted at 49s. to 50s. per quarter.

BOARD OF AGRICULTURE.

THE personnel of the new Board of Agriculture, appointed by the Governor-General as from 30th April, 1923, is as follows: Sir J. G. Wilson, Messrs. E. Hall, G. L. Marshall, W. Perry (Government nominees), E. D. McLennan (Auckland District), E. Averill (Hawke's Bay), W. B. Grant (Taranaki), J. H. Perrett (Wellington), J. A. Haycock (Nelson and Marlborough), D. W. Westenra (Canterbury), J. Begg (Otago), and D. Marshall (Southland). Sir J. G. Wilson has been named as President in accordance with the provisions of the Board of Agriculture Act.

IMPORTATION OF LIVE-STOCK FROM BRITAIN.

EARLY last year, owing to the prevalence of foot-and mouth disease in the United Kingdom, it became necessary to prohibit the importation into New Zealand of cattle, sheep, and swine, also fodder therefor, from the former country. The Department of Agriculture has been keeping close touch with the position, and as recent advices disclose that the disease is apparently not of an epidemic nature it has now been decided to again permit importations subject to certain conditions, which are similar to those in operation prior to the last series of outbreaks. Briefly, these conditions are as follows: No shipment allowed from part of the country for one month from the date of the outbreak. For the succeeding two months shipments only allowed from outside a radius of fifteen miles: Provided that if animals are taken from an area free from disease and quarantined in approved premises under veterinary supervision for fourteen days prior to shipment, then such shipment would be allowed.

An Order in Council will be issued shortly formally removing the embargo on the live-stock stated, but in the meantime all fodder will have to be dumped before vessels carrying stock from Great Britain enter port in New Zealand.

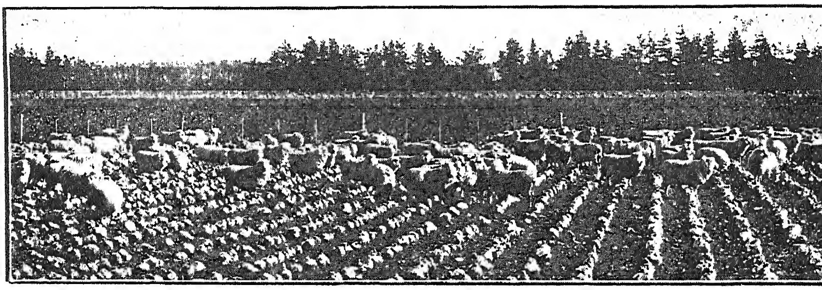
EXPORT OF FRUIT AND PLANTS TO MONTE VIDEO.

WITH reference to the certificate required to accompany fruit, plants, &c., shipped from New Zealand to Monte Video, the Department has received advice to the effect that the Uruguayan regulation governing this matter has now been amended, and reads as follows: "Every consignment of plants, their parts, and fresh fruit, must be accompanied by a sanitary certificate of the exporting country, issued by the competent authorities, declaring that the same have been inspected, and are free of diseases harmful to plants, fruit, &c."

San Jose scale being covered in the above, the special certificate previously required in regard to this disease is not now necessary. As the Department's ordinary export certificate of freedom from disease practically complies with the Uruguayan requirements, this certificate will be issued in future by the Department's officers in connection with any consignments of fruit, plants, &c., exported to that country. (For previous reference to this matter see *Journal*, August, 1922, page 127.)

FORTHCOMING WINTER SHOWS.

Waikato Winter Show Association: Hamilton, 29th May to 4th June.
Otago A. and P. Society: Dunedin, 5th to 8th June.
Taranaki Metropolitan Agricultural Society: New Plymouth, 6th to 9th June.
Manawatu A. and P. Association: Palmerston North, 19th to 22nd June.
South Taranaki Winter Show Company: Hawera, 3rd to 7th July.
Auckland A. and P. Association: Auckland, 17th to 21st July.



The New Zealand

Journal of Agriculture.

Vol. XXVI.—No. 6.

WELLINGTON, 20th JUNE, 1923.

STUDIES IN NEW ZEALAND SOILS.

THE MICA-SCHIST SILTS.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

WHEN the traveller through Central Otago alights from his coach his first action perhaps is to shake himself free from the millions of spangles of mica-schist which have settled on his clothing during the journey. He sees the mote in the sunbeam here glisten and flash with a new beauty of its own. These particles differ altogether from the dust of other journeys, being tabular or lamellar in form instead of irregular. This entirely novel experience impresses the observant visitor with the great difference between the type of soil over which he is travelling and that more weathered and mixed type near the east coast.

In the plains and river-terraces of this area there have been sorted out, from the harder portions of the metamorphic schists which comprise the country rock, the softer portions, and these have been deposited in the old lake-basins and river-terraces, as one would expect from the shape of the particles, in the form of a tightly packed soil. These soils respond to cultivation and irrigation in a marvellous manner.

The characters which this micaceous rock confers on the resultant soil are quite as important chemically as physically; for it would seem from the limited experience which one may derive from the few soils

analysed that wherever such soils are found in the South Island they exhibit the same excellent chemical characters. When the mica-schist is carried away from the arid portion of Otago by rivers such as the Taieri and the Clutha, and deposited nearer the coast, forming plains and river-terraces under more favourable conditions as regards rainfall, the diluted soils are extremely fertile. Where the mica-schist soil is found in wet districts the soils are likewise extremely fertile, after the land has been stirred and the physical state due to the packed condition improved by liming and green or stable manuring. The fertility of mica-schist soils in New Zealand has been remarked by many, but the cause has been attributed to either the lime or the potash they contain. Thus Captain Hutton, F.R.S., in 1875 (" Report on the Geology and Goldfields of Otago," page 95), stated that " the soils of Otago taken as a whole are decidedly above the average in quality, and this appears to be owing to the great extent of mica-schist exposed at the surface, the decomposition of which has supplied more or less directly almost all the soil in the province. That this schist contains a considerable amount of lime is proved by the incrustation in nearly all the caves in it ; and the good quality of the soil derived is well seen in the Dunstan district, which is remarkably fertile when irrigated."

The truth appears to be that the fertility of the mica-schist soils of Otago and Westland is due not to the lime or to the potash or to the total phosphoric acid they contain, but to the comparatively large amount of available phosphoric acid present, a point of great theoretical and practical importance. Available phosphoric acid has a very great influence on the growth of the young plant, stimulating the growth of the roots in a remarkable way, a property which is very valuable when utilized in raising plants whose root-systems it is desirable to develop, such as those of the turnip, potato, and mangold. Available phosphates also hasten the ripening of a plant, and for this reason are valuable as a dressing for all cereals. The fact that available phosphate is abundant in Otago soils but deficient in most New Zealand soils, especially those of the North Island and northern parts of the South Island, suggests that some day Central Otago, with its splendid summer climate and irrigation possibilities, may become the granary of New Zealand.

The proportion of readily available phosphoric acid present in mica-schist soils is about two or three times and sometimes even as much as four times the quantity that one finds in an ordinary fertile soil. Thus, assuming that an ordinary soil yields from 0·015 to 0·02 per cent. of phosphoric acid when it is agitated with a 1-per-cent. solution of citric acid for twenty hours (B. Dyer's method, Hall's modification), a micaceous soil may contain 0·04 to 0·08 per cent. This amount would be equal to a dressing of 8 cwt. to 16 cwt. of phosphoric acid per acre, which it would take from 2½ to 5 tons of ordinary superphosphate to supply. This will give some idea of the potentiality which lies hidden in the glittering dust of these micaceous lands.

It must not be supposed that this type of soil is exceptionally rich in phosphate only when it occurs in arid districts. It is as rich when it occurs on the very wet western coasts of the South

Island. Neither must it be thought that the percentage of total phosphoric acid which occurs in the parent rock is exceptionally high, for it is not. There is either something in the lamellar method of weathering which enables the phosphate to become available, or, alternatively, the metamorphism—the pressure and heating—to which the rock has been subjected has made the phosphate available, acting perhaps as the furnace acts in smelting the iron-ore in the Bessemer process, when the slag of the ore becomes converted into a fertilizer in which 80 per cent. of the phosphate is available. It would seem, therefore, that while the proportion of available to total phosphoric acid in ordinary soil is about 10 per cent., in a mica-schist soil it would amount to from 25 to 30 per cent. of the total present.

The experience of the mica-schist type of rock in other countries is rather contradictory. Primrose McConnell (England) in "Agricultural Geology" (1902), states that mica-schist crumbles down with comparative ease and gives a soft friable deep layer of rich soil. On the Breadalbane chain of hills (Ben Lawers) this is exemplified by the intensive flora of alpine and Scandinavian character, rich and well developed in contrast to the poor appearance on the granite of Braemar and Ben Nevis. The pines and larches are magnificent on the decomposed mica-schists of the Highlands generally, but are poor stunted sticks on their cold clays of granite. On the Kingsbridge estuary, in Devon, there is a flourishing vegetation on this rock, including orange and lemon growing in the open air where sheltered from the south and south-west winds. In Ireland the rich green pasture and good "heath" land on the same formation near Knocklayd and Ballycastle, County Antrim, may be noted.

Hilgard, the great American soil chemist, in "Soils" (1906), states that mica-schist, being a mixture of quartz and mica only, not only weathers slowly, but also supplies but little of any importance to plants in soils formed from it. Such soils would be mostly absolutely barren but for the frequent occurrence in this rock of accessory minerals that yield some substance to the soil. Yet it remains true that as gneiss and mica-schist are among rocks in which mineral veins most commonly occur, the proverbial barrenness of mining districts is frequently traceable to these rocks. The difference between American and British opinion regarding the value of mica-schist as a soil-former is remarkable, but probably has some simple explanation, such as the amount of phosphate which is present. There are, moreover, several distinct kinds of mica, which vary greatly in the rate at which they break down or weather in the soil. It is not to be inferred from this that the phosphate is necessarily included in the mica; but wherever mica occurs in South Island soils it appears to be an indication of the presence of available phosphate in good quantity.

H. W. Wiley, in "Principles and Practice of Agricultural Analysis" (1906), points out that the schists include an extremely variable class of rocks of which quartz is the prevailing constituent, and which as rocks are deficient in potash and other important ingredients of plant-food.

Rastall, in "Agricultural Geology" (1916), suggests that such rocks yield soils of all kinds, their character being dependent largely on the climatic conditions. Where these are favourable the soils yielded by the rocks are often very fertile. He attributed the comparative barrenness of these formations in Britain, which occur among the Highlands of Scotland, to the climate and elevation of those parts. In many tropical regions where conditions favourable to the weathering of such rocks exist great fertility results.

In the accompanying Table 1 are given some analyses of mica-schist soils made in this Department's chemical laboratory from time to time. They comprise details of the composition of soils

TABLE 1.—CHEMICAL ANALYSES OF MICACEOUS SOILS.

Results, except *, are percentages on soil dried at 100° C.

Laboratory No.	Locality.	Volatile Matter.		Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method, Hall's Modification (Available Plant-food).				Hydrochloric-acid Extract (Total Plant-food).			
		*At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash K_2O.	Phosphoric Acid, P_2O_5.
L 295	Earnscleugh, Clyde	2·48	4·60	0·140	..	..	0·014	0·052	0·35	0·38	0·20	0·10
B 944	Cromwell ..	0·64	0·34	0·080	..	..	0·011	0·069	0·41	1·01	0·16	0·24
B 1037	Kurow	1·70	5·51	0·250	..	..	0·018	0·058	0·90	0·85	0·16	0·27
J 11	Alexandra ..	32·00	1·12	0·056	..	..	0·008	0·064	..	..	..	..
J 77	Maniototo ..	4·52	5·95	0·189	..	..	0·031	0·041	..	..	..	..
P 278	Composite, Central Otago	1·92	6·05	0·254	0·197	0·055	0·037	0·031	1·23	1·02	0·66	0·09
B 848	Stirling	0·74	2·82	0·100	..	..	0·015	0·072	0·74	0·80	0·10	0·19
E 1233	Maruia Plains, Murchison	1·58	4·62	0·152	..	..	0·014	0·050	1·02	1·26	0·58	0·20
H 570	Kokatahi ..	..	4·70	0·182	..	..	0·013	0·056	..	..	..	..
H 572	Hokitika ..	..	1·48	0·084	..	..	0·006	0·080	..	..	..	..
J 306	Koiterangi ..	2·00	4·02	0·150	..	..	0·016	0·056	..	..	..	..
J 307	" ..	0·54	1·45	0·056	..	..	0·012	0·087	..	..	..	..

NOTE.—In H 572 potash by hydrochloric acid is 0·24 per cent, and potash by hydrofluoric acid 3·09 per cent.

TABLE 2.—ANALYSES OF MICA-SCHIST ROCKS IN THE KOKATAHI WATERSHED, WESTLAND.

(1.) Schist from Jumbletop watershed of Toaroha River. (2.) Quartz-mica-schist from Toaroha Gorge. (3.) Mica-quartz-schist from Mikonui River. (8.) Schistose rock from Mikonui River. "C" and "D," American analyses quoted by Clarke in "Data of Geo-Chemistry" (1908).

Constituents.	(1.)	(2.)	(3.)	(8.)	C.	D.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Silica (SiO_2)	68·09	70·18	71·93	70·18	70·76	64·71
Alumina (Al_2O_3)	14·34	14·15	13·39	16·26	14·83	16·43
Ferric oxide (Fe_2O_3)	0·16	0·28	0·12	0·46	1·46	1·83
Ferrous oxide (FeO)	4·39	3·53	3·31	2·84	3·09	3·84
Manganous oxide (MnO)	0·26	0·32	0·36	0·27	..	Trace.
Lime (CaO)	1·48	1·21	2·45	2·87	0·36	0·08
Magnesia (MgO)	1·57	1·01	0·91	2·58	1·99	2·97
Potash (K_2O)	3·23	2·48	2·20	0·78	3·50	5·63
Soda (Na_2O)	2·90	4·95	4·09	0·43	0·47	0·11
Titanium oxide (TiO_2)	0·66	0·46	0·49	0·70	0·33	0·72
Carbonic anhydride (CO_2)	..	0·60	..	0·08	..	..
Loss on ignition (excluding CO_2) ..	2·09	1·09	0·80	1·84	2·79	3·10
Phosphoric anhydride (P_2O_5) ..	0·28	0·17	0·18	0·32	0·26	0·02
Total	99·45	100·43	100·23	99·61	99·84	99·44

(Nos. 1, 2, 3, and 8 from Dominion Laboratory reports.)

from the wet Westland and the arid central district of Otago. Included also are the results yielded by a remarkably fertile soil from Maruia Plains, near Murchison, in the south Nelson district. Dr. Henderson, of the Geological Survey, who collected this sample of soil, informs me that it is derived from a mica-schist rock. A composite made up of samples of soil from Roxburgh (two), Beaumont, Naseby, Sutton, Manuherikia, Maniototo, St. Bathans, and Frankton, all in Central Otago, is given under No. P/278. The analysis of this composite sample bears out the opinion expressed by Professor Park in Bulletin No. 2 of the Geological Survey, that "the soil possesses a latent richness that the casual observer would hardly suspect. By the application of water the wilderness is transformed into fruitful gardens and prosperous farms. The conservation and distribution of water for irrigation purposes will in time convert the plains and valleys of Central Otago into one of the most prosperous agricultural districts in New Zealand."

Some analyses of unweathered mica-schist rocks are given in Table 2, from the Geological Survey Bulletin No. 6, and accompanying them are two samples, "C" and "D," of American mica-schist rocks from Clarke's "Data of Geo-Chemistry." Analyses of other schist rocks from Central Otago unfortunately lack the requisite information and are therefore not given.

These mica-schist soils often show a deficiency in nitrogen, and are all deficient in organic matter. In the wet districts the available potash is often deficient, although present in very great quantity in an unavailable state. The treatment of such soils with quick or caustic lime has been suggested by the writer as a remedy, in the bulletin "The Wire-basket Method of Testing Soils" (1907). The available phosphoric acid is, as has been stated, present in great excess, but the total is sometimes present in quite moderate amounts. The happy position of Otago in the matter of available phosphate in the soil, compared with other parts of New Zealand, is summarized in the New Zealand Official Year-book for 1913, page 549, and in this Department's Bulletin No. 48, "Phosphates," by the writer. Only 3 per cent. of the soils from Otago analysed were found to be deficient in available phosphate, whereas the percentage deficient in Wellington was 33 and in Auckland 65.

New Rabbit District.—The Patea-Waitotara Rabbit District has been constituted for the purposes of Part II of the Rabbit Nuisance Act, 1908.

Rabbit Control and Trapping.—Regulations under the Rabbit Nuisance Amendment Act, 1920, relating to the destruction of rabbits in the Mangapiko and Kawa West Rabbit Districts, have been gazetted. These provide that every owner of land who is served with a notice to destroy rabbits in terms of the Rabbit Nuisance Act, 1908, must do so either by laying poison or by the fumigation or filling-in of burrows. Where it is desired to substitute other means of destroying the pest, application for permission to do so must first be made to the Rabbit Board, whose decision is final. Further, within seven days of service of the notice, all trapping on the land must cease for a period of six months. The penalty for a breach of the regulations is a fine not exceeding £10. The full text of similar regulations governing the Hurunui Rabbit District was published in the *Journal* for November last (page 315).

THE GRASSLANDS OF NEW ZEALAND.

PRINCIPLES OF PASTURE-ESTABLISHMENT.

(Concluded.)

E. BRUCE LEVY, Biological Laboratory, Wellington.

QUALITY OF SEED AND METHOD OF SOWING.

WITH regard to agricultural seeds there should be only one quality sown—namely, the best. It may be laid down as an axiom that "cheap" poor seed is always expensive. Many samples of reputedly cheap seeds have been analysed at the seed-testing station of this Department, and never in one instance could the individual living seeds of the sample be called cheap. In connection with the accompanying photograph of 5 grams of a typical "cheap" mixture (Fig. 111), it was worked out that the real value of this mixture was approximately 4¾d. per pound, and unless a farmer could buy such a mixture for considerably less than 4¾d. he could not in any way congratulate himself on his deal. It is true he will not get a pound of a good mixture for 4¾d., but he will get more living desirable plants in 4¾d. worth of a good viable clean line of seed, and it is the living desirable plants that the farmer requires and which he pays to get. The price asked for this mixture was in the neighbourhood of 6½d. per pound, which makes it quite an expensive seed as far as the viable seeds in it are concerned.* There may, of course, be times when the farmer can strike a bargain in buying seeds, but the selection of cheap mixtures demands great judgment on the part of the buyer to ensure that the bargain is not on the side of the vendor.

It is admitted that there are certain types of country which demand cheapness of sowing. A cheap sowing, however, does not imply that the seed used should be a cheap, low-grade seed of any particular variety, but that the amount of money spent per acre must be low. Just how to ensure this cheapness and also secure satisfactory results is a problem, with our present knowledge, difficult of solution. It is an extremely unfortunate thing for farmers located on poor rough country that the seeds of plants fitted for such country are expensive, owing no doubt to the cost and difficulty of harvesting them. Cheapness per acre of seeding can be secured (1) by limiting the amount sown—by putting in a certain amount of the desirable elements, and then, by spelling, allowing a certain amount of reseeding; (2) by sowing seeds of inexpensive varieties—but unfortunately rye-grass, Yorkshire fog, and suckling-clover are about the only inexpensive ones that could be used, and rye-grass is of no use as a permanent element on such country; (3) by using "cheap" mixtures, dressings, seconds, &c., which are usually sold

* The same mixture is shown semi-diagrammatically, in greater detail, on page 166 of the *Journal* for September, 1918.

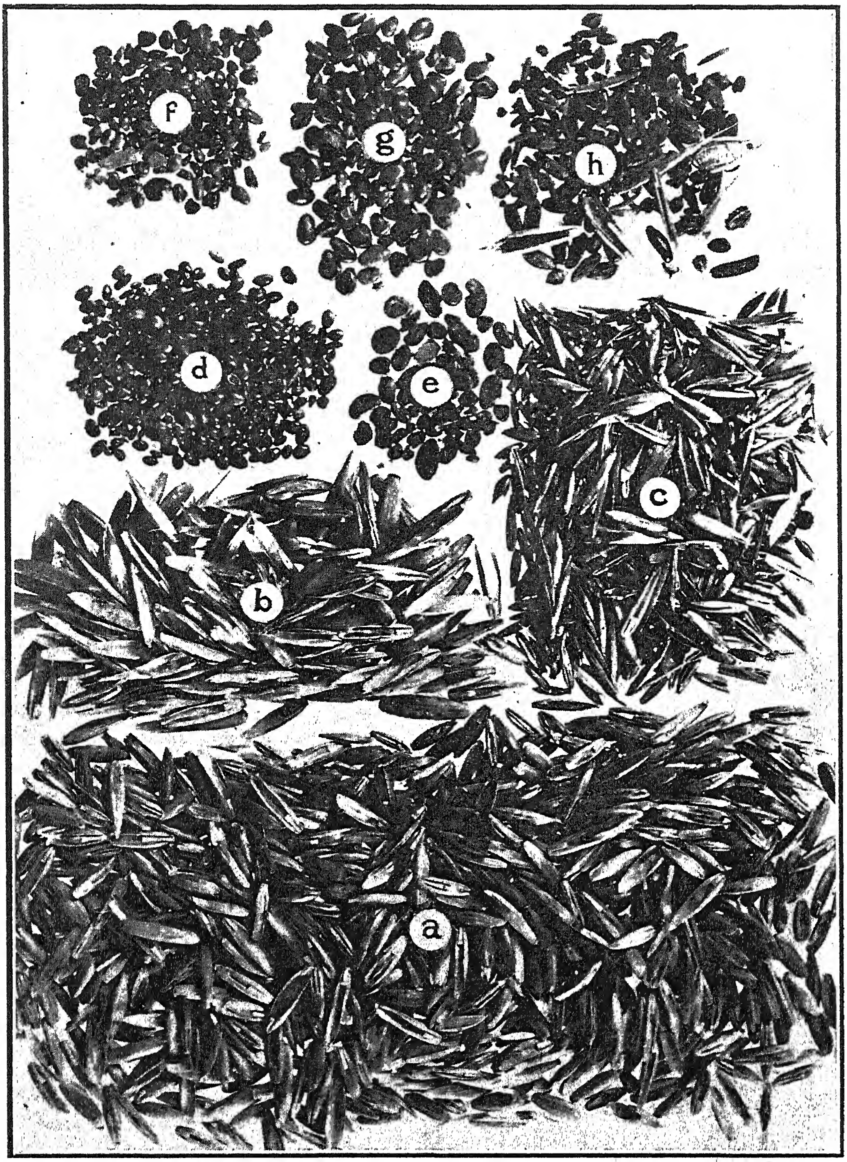


FIG. III. DISSECTION OF 5 GRAMS OF A TYPICAL "CHEAP" MIXTURE.

(*a*) Perennial rye-grass, mainly kernels, showing it has been through the mill many times; (*b*) Italian rye-grass—good bold bright seed put in to give the sample a good colour and general appearance; (*c*) Chewings fescue, crested dogstail, and a few cocksfoot-kernels; (*d*) suckling-clover; (*e*) mixed clovers, lucerne, and English trefoil mainly; (*f*) white clovers (many brown seeds); (*g*) red clover (many brown and shrivelled seeds); (*h*) weeds.

[*Photo by E. B. Levy.*

at so-much per pound. The mixture shown in the photograph is of this class, and farmers undoubtedly will be wise to leave such lines alone. At certain times rye-grass and cocksfoot seconds may be bought fairly satisfactorily, but these so-called cheap mixtures as a whole represent little better than seed-cleanings to which a small quantity of good-coloured seed—generally of Italian rye-grass—has been added for the purpose of giving the sample a good general appearance. There is a fourth alternative—namely, for the farmer to grow his own seed. This last method scarcely comes within the scope of the present article, but there is no doubt that where a farmer has difficult country to grass the growing on some cultivated portion of his farm of small areas of those crops the seed of which he requires is well worth considering. Very rough threshing methods could be adopted, and often, too, the straw could be strewn about the burn. Expensive seeds like brown-top, Lotus major, yarrow, subterranean clover, &c., might well be secured in this manner.

In the buying of agricultural seeds in general there are three main considerations: (1) Germination of the seed; (2) purity of the seed; and (3) its place of origin.

GERMINATION.

Germination, or the capacity of the seed to grow, is the prime consideration in the buying of all seeds. High germination means high vitality: high vitality means success in the competition that will follow in the pasture. No amount of cultivation of the land and no amount of manure applied can make a dead seed grow. The farmer, at present, has no actual guarantee that the seed he buys will grow, but that the seed-merchants of New Zealand can be relied on very largely in this prime matter of germination is reflected in the statistics of our seed-testing station, where out of ten thousand samples tested last year only eighty samples were sent in by farmers. The farmer can always have resource to the official seed-testing free of charge, both for germination and purity, but so far as his ordinary seed-buying is concerned he is advised rather to demand from his merchant seed bearing a high germination percentage shown by the official test. "Government-tested" seeds are often displayed by vendors, but it does not suffice to buy merely on the strength of this label, for the test may show the seed to be of high or of low germination. The seed should have a high germination as shown by the official test. The foregoing course is recommended because the farmer, as a rule, does not buy his seed until he is practically ready to sow, and it would take fully a week to secure a germination test even with the quicker-germinating seeds. Further, if the test proved the seed of low germination the line would have to be returned to the vendor and a fresh stock secured, meaning another week's delay. The farmer, of course, could get samples preparatory to buying, but then he has no guarantee that the seed ultimately delivered would be of the same line as that from which the sample was originally drawn.

Practically all seed-merchants at the present day know the germination of the seed they have in stock, and while they may charge a little more for their high-germinating lines, yet these are undoubtedly the best ones to buy. High germination means great vitality;

high-vitality seeds come through the ground often several days before low-vitality ones, and the weakening influence of unfavourable conditions on the establishment of the former is not nearly so marked as it is on the lower-vitality seeds.*

It must be remembered that all seeds deteriorate in vitality on being stored. Some species are more susceptible to deterioration than others. Chewings fescue may lose its vitality in two years after harvesting, and this is a very important point to be considered in the buying of that seed ; current season's seed should always be demanded. Meadow-fescue, in common with Chewings fescue, is also a short-lived seed, and frequently seed arrives in New Zealand from America with a very low germination. Meadow-foxtail and Poa trivialis, two expensive seeds, demand attention in the buying, as there is at times low-germinating seed on the market. In purchasing paspalum, also, the safest plan when buying without a knowledge of the germination is to stipulate Australian-grown seed, for the New-Zealand-grown seed is often extremely low, and may, in fact, germinate nil or only as little as 3 or 4 per cent. Many failures to secure a strike of paspalum are due to sowing this locally grown seed.

As far as the other pasture seeds are concerned, with reasonable care in buying only high-grade seed there should be little danger of failure through poor germination.†

PURITY OF SEEDS.

As far as the purity of the seeds is concerned there is no doubt that the general well-machine-dressed lines of merchants are quite satisfactory for sowing. There are, however, one or two noteworthy exceptions. Southern crested dogstail and imported alsike are likely to contain Californian thistle (Fig. 112). Auckland-grown Lotus major is likely to contain dodder and Lotus hispidus. This latter may have been purposely added as an adulterant, but frequently the crops harvested are very mixed. Brown-top may contain red-top, the seed of which is almost identical and distinguishable only with quite a high magnification of the microscope.

Owing to the resemblance of certain kinds of seeds to one another the practice of adulteration is not unknown, and while in certain cases substitution of one seed for another may occur accidentally, one finds that in the case of mixed seeds resembling one another the mixture is usually sold at the figure of the higher-priced seed, indicating that there might have been something of method in the mixing. It must be said, however, for the seed-merchants of New Zealand that wilful adulteration is now seldom practised, and having regard to the fact that it is so easy of accomplishment this certainly is to their credit. It still remains a fact, however, that all merchants are not so scrupulous as one might wish regarding the sale of seeds. As this article is written a sample of white clover offered to a farmer by a North Island merchant has been received into the Laboratory here from the farmer concerned, and it contains 60 per cent. of suckling-clover. The price

* See photograph of turnip-seed on page 96 of *Journal* for August, 1918.

† For germination of agricultural seeds in 1921 and 1922, see tabulation by Nelson R. Foy in *Journal* for April, 1923, page 250.

asked for the line is 2s. per pound, and in view of the fact that suckling-clover may be bought for 6d. per pound the line is extremely expensive. The real value of this line is 1s. 2½d. per pound, whereas the merchant was charging only 3d. per pound less than the present ruling market rate for white clover.

The following seeds may be readily adulterated in the manner indicated, and care should be exercised in buying them: White clover with suckling-clover, clustered clover, or haresfoot trefoil; Lotus major with Lotus hispidus; Poa trivialis with Poa pratensis; brown-top with American red-top; Western Wolths rye-grass with

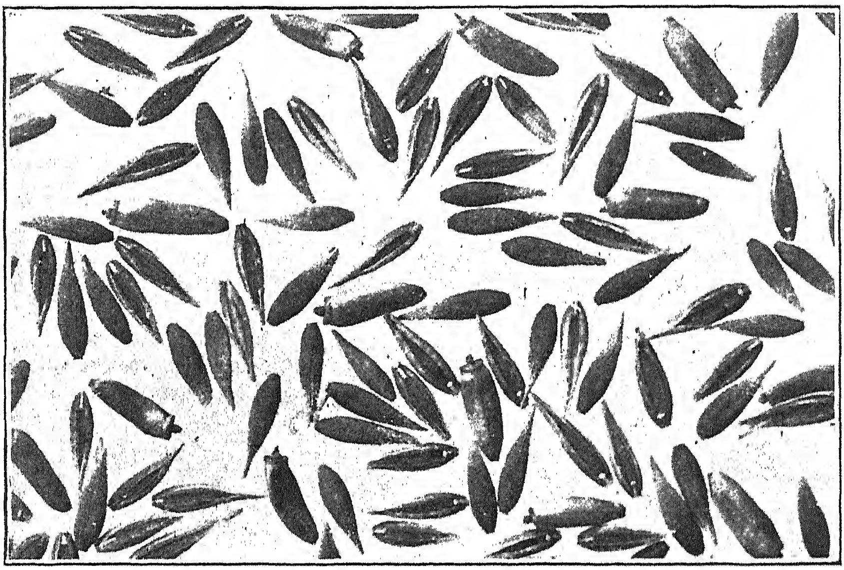


FIG. 112. CALIFORNIAN THISTLE IN SAMPLE OF SOUTHERN CRESTED DOGSTAIL, ENLARGED 6 DIAMETERS.

The thistle-seeds are readily seen in the photo by their rimmed end with small projection.

[*Photo by E. B. Levy.*

Italian rye-grass; meadow-fescue with perennial rye-grass; lucerne with English trefoil. All these adulterations, with the exception of Western Wolths and Italian rye-grass, can be detected by the seed expert, and there is no doubt that our seed-testing station, with its ready diagnostic methods, has played a very important part in reducing wilful adulteration. It would appear, however, from numerous analyses made in the laboratory that just so long as the farmer is prepared to use only well-machine-dressed seeds and to pay the ruling market rate the question of the purity of seeds need scarcely cause him any worry; but just so soon as he strives to strike a bargain, then should his movements be very cautious.

In undressed seeds there is likely to be a whole host of impurities. Danish cocksfoot as it lands in New Zealand is frequently infested with ox-eye daisy; imported timothy and alsike may contain Californian thistle; while imported red and white clover frequently contain dodder.

This recommendation to sow only machine-dressed seed may seem unsound to many farmers on old arable land, where undoubtedly the weed-seed content of the soil is often enormous—so much so that a few more added by way of the grass-seed mixture seems to be insignificant. In the *Journal* for January last, page 20, the writer records that in one single strike over fifteen million weed-seeds germinated per acre, representing a seeding of about 100 lb. The really great danger of sowing impure seeds, however, lies in the fact that new extremely troublesome weeds may be introduced. Here, again, the merchant often gets blamed for supplying clients with impure seeds, when the root of the trouble lies in the seed or plants already in the farmer's field. A very common complaint in many districts is the rapid appearance of Californian thistle in fields that have been ploughed out of grass and then resown. The merchant almost invariably gets blamed for the thistles, whereas really in 99 cases out of 100 they are young shoots from old worn-out plants regenerated by the cultivation.

From another aspect, however, the machine-dressed seeds are the ones to use, for, apart from any misgivings one who takes a pride in his farming might have in knowingly applying weed-seeds to the land, there is that one important attribute usually associated with machine-dressed seeds—namely, their capacity to grow. With machine-dressed seed one is more certain of getting seeds that will grow than when buying undressed seeds. Nevertheless because seed is machine-dressed it does not necessarily mean that it is of high germination.

PLACE OF ORIGIN AND STRAIN OR TRUENESS TO TYPE.

As far as our grasslands are concerned there has been virtually no selection work on the ordinary pasture plants, so that no definite strains have been worked up into marketable products. There is, however, a general consensus of opinion that the nationality or place of origin of our pasture seeds is very important, although not many definite tests made in New Zealand are available. A short consideration of some of the leading plants may serve to demonstrate this factor.

Perennial Rye-grass.—In those districts where perennial rye-grass remains permanent in the pasture over a long period the seed from crops grown there is looked upon as being superior to that grown in districts where, owing to the unsuitable soil conditions, rye-grass does not last for more than two or three years. Hawke's Bay and Sandon rye-grass, for instance, commands a price much in excess of that commanded by Canterbury or Southern rye-grass. In a price-list before me Hawke's Bay rye-grass is quoted at 7¾d., Sandon 6½d., Southern 4½d., and Canterbury 4¾d. per pound respectively. Whether or not the persistence of the Hawke's Bay and the Sandon rye-grass is due to some inherent quality of these strains, or whether the soil conditions alone are responsible, it is extremely difficult to say. If the plants of those soils have some inherent quality by which they can persist,

then these strains are undoubtedly worth the extra money; but if soil conditions alone govern their persistence, then the Canterbury or Southern seed is a far better proposition at the price, provided always that the germination capacity of each is more or less the same. For all short-rotation pastures Canterbury or Southern rye-grass at the above prices should undoubtedly be used, but there are certain indications that for truly permanent pastures Sandon or Hawke's Bay rye-grass is preferable, although we have very little definite experimental work to support this recommendation.

In England the indigenous (Native) forms of perennial rye-grass are looked upon as being superior to any of the other nationalities. This indigenous form is a close dense one which bears, proportionately to seed-heads, a great number of barren shoots—*i.e.*, shoots that do not run up to form seed-heads. Practically all the other forms are not dense and tufted, and nearly all their shoots run up into seed-heads. Thus with these is produced a mass of seed-heads and virtually no "bottom." Whether or not the Hawke's Bay and Sandon rye-grass is after the style of the indigenous forms of England only research work can prove, but undoubtedly such is the type we require in New Zealand for our truly permanent pastures.

Cocksfoot.—There are four more or less distinct strains of cocksfoot available to the New Zealand farmer—Akaroa, Canterbury Plains, North Island, and Danish. The Akaroa cocksfoot is of old repute, and undoubtedly it is a good strain, but of later years the seed has been comparatively light, and the germination is often low for cocksfoot. The small seed, however, seems to be a definite character of this strain, for Stapleton* records from his harvest of cocksfoot grown from Akaroa seed that a thousand seeds of this strain weighed 0·95 grains, as against 1·30 grains for a thousand seeds from a crop of Danish origin. Stapleton's experiments on our Akaroa cocksfoot are extremely interesting and important. Akaroa cocksfoot agrees in nearly all details with the indigenous cocksfoot of England, which the English farmer looks upon as the best cocksfoot he can procure. Akaroa cocksfoot is like it in two essential respects—firstly in its dense bottom growth, and secondly in its resistance to frost injury. Danish cocksfoot in Stapleton's trials was more open in the bottom and was extremely subject to frost injury. This is extremely important to farmers in the South Island or in districts subject to heavy frosts. Danish cocksfoot, in view of its big seed, its usually high germination, and its comparative cheapness, is very tempting to use. With regard to the other cocksfoot strains in New Zealand the writer has no information to offer, except that when buying Canterbury Plains seed the purchaser should see that the proportion of perennial rye-grass in it is not unduly high.

Crested Dogstail.—There are two main districts in New Zealand producing crested dogstail—southern Otago and Southland, and Sandon. To any farmer who is afraid of introducing Californian thistle on to his place the use of Sandon seed is strongly recommended. The respective merits of the two strains have not been worked out.

* Preliminary Investigations with Herbage-plants, *Welsh Plant-breeding Station, University College of Wales, Aberystywth,* Series H No. 1, 1922.

Paspalum.—Having regard to the poor germination of the New-Zealand-grown paspalum, Australian seed should be used, unless the farmer is buying on a knowledge of the germination of the line. There is no doubt that good seed could be produced in New Zealand, but the methods of harvesting would have to be considerably modified. This low germination of the New Zealand seed is particularly disappointing, for it would appear that in almost all seeds there arises a certain strain of what may be looked upon as acclimatized plants, and the seed from these should be better fitted for conditions in that district or country. It would therefore seem reasonable to expect that in the course of time certain strains of paspalum could be produced in New Zealand by acclimatization that were much more resistant to frost injury. The introduction and sowing of Australian seed is certainly unsound from this point of view, but until better harvesting methods are adopted in the North the sowing of the better-germinating Australian seed must be recommended.

White Clover.—With regard to the seed of white clover, undoubtedly none other than the New-Zealand-grown seed should be used. The superiority of the New Zealand seed over the commercial imported is beyond question, particularly from a duration-of-life point of view. The imported white will produce well for the first year or so, and then it will go out. Plots laid down by the writer at the Central Development Farm, Weraroa, were sown with imported white clover, and within two years there was not a single plant left, whereas in the same area where only pure grass sowings were made white clover from seed already in the soil established itself and spread out over the plots, and lasted well until the plots were dug up several years later. Most of the white-clover seed harvested in New Zealand is either from old pastures or from land, like the wheat-stubbles of Canterbury, where the clover comes in naturally after the wheat crop has been harvested. Trials in Wales by Stapleton (*l.c.*) go to show that our New Zealand white clover is in very many important respects similar to the wild white clover of England, but at the time of writing they had not been going sufficiently long to prove the lasting-qualities of our seed compared with wild white.

Red Clover or Cow-grass.—There can be little doubt that so far as the New Zealand trade is concerned the seed of cow-grass and of red clover are one and the same. A large-seeded line is almost invariably well polished and sold as cow-grass, for which 2d. per pound more is charged. The smaller seed is usually not polished, and is sold as red clover. In every case it is probably best to buy the cow-grass even although the price is a little more, for a big robust seed of its kind nearly always indicates that a vigorous seedling will arise from it. The New-Zealand-grown seed is undoubtedly of very fine quality, and according to Stapleton's trials in Wales (*l.c.*) comes into the group known as the cow-grass or Broad Red type. From the point of view of persistence, however, these trials go to show that certain English strains, such as the English Late Flowering and Montgomery Red, are superior to our strain. In Denmark, also, our red-clover seed is not looked upon as being particularly hardy. There is no doubt that New Zealand can grow wonderfully fine red-clover seed, and it certainly does look as if our strain is capable of improvement for

persistence and hardiness. With respect to all our pasture plants, however, the call for the plant-breeder is insistent, and unquestionably there is scope in our grasslands for an immense amount of selection work. Strains of seeds, also, from all over the world should be tried out and the best perpetuated by an efficient mother-seed-growing establishment. The plant-breeder alone is of comparatively little use; there must also be some seed-growing organization to carry the strain on from the nursery stage.

PREPARATION OF THE SEED-BED AND METHOD OF APPLYING THE SEED TO THE LAND.

It may be claimed almost without exception that our pasture plants prefer a well-consolidated seed-bed for their establishment, and as a rule they do not require to be deeply buried, particularly the clovers. It may be put down as a fairly general rule that the optimum depth for most seeds varies according to size, and as a rule the seeds should be buried some two and a half times their longest axis, neglecting the external appendages such as the husks and glumes of grasses and cereals. In the case of rye-grass and cocksfoot, &c., this would give a depth of between $\frac{3}{8}$ in. and $\frac{1}{2}$ in., and with oats, prairie-grass, &c., 1 in. to $1\frac{1}{4}$ in.; while with the finer grasses like crested dogs-tail and timothy approximately $\frac{1}{4}$ in. would suffice. In the case of the clovers, white clover and seeds of a similar size would be buried $\frac{1}{8}$ in. to $\frac{3}{16}$ in. deep, while red clover, lucerne, &c., would vary from $\frac{3}{16}$ in. to $\frac{3}{8}$ in. A good deal, however, depends on the soil. In heavy soil the depths specified should not be much exceeded, but on lighter sandy or loamy soils a greater depth can be approached with advantage. In a mixed sowing it is only possible to regulate the depth to suit in an average way the whole mixture, but the necessity of not burying the seed too deeply must here be stressed. In spring sowings on light land likely to dry out in the early summer fairly deep sowings should be made; up to $\frac{1}{2}$ in. or even $\frac{3}{4}$ in. is not too deep. The land should be well worked and a good tilth prepared, but this must be consolidated by the roller before the seed is applied.

There are several methods of applying the seed. The old-fashioned broadcasting by hand is still in vogue, and is about the only successful method for the sowing of bush-burns and the like. Undoubtedly the most efficient broadcasters on ploughable country are the specially constructed grass-seed distributors or the drill, the spouts having been removed and the seed dropping from the box on to the land. Special grass-seed boxes are attached to the better and more modern makes of drills. Whether the seed is broadcasted by hand or sown by the drill or distributor it should fall on a Cambridge-rolled surface, or else the roller should follow the drill. Often the seed sown is simply rolled in, but the hard-rolled bare surface is not good from a moisture-conservation point of view, and undoubtedly this surface should be roughened by the use of the chain harrow. If the seed is sown on a Cambridge-rolled surface the chain harrow should be used to cover, and is usually quite sufficient. The tine harrow is frequently used to cover the seed, but there can be little doubt that the tine harrow does bury a large proportion of the seeds too deeply.

On light land seed is usually drilled through the coulters, as by this means a greater cover can be secured for the seed. The disadvantage of this method, however, lies in the fact that the seeds are all crowded together in rows 7 in. apart, and very frequently the plants never meet between the drills; consequently a great deal of bare ground is frequently present in fields sown down in this way. This difficulty can be largely got over by drilling half the seed one way, and then drilling the other half of the seed across the first drills. By this means a very much better distribution of the seed is effected without any corresponding defect in the cover secured for the seed. The sowing, however, takes twice as long.

In the sowing of small seeds it is a frequent practice to mix the seed with the manure, and drill through the coulters or broadcast from the box. This practice is quite good provided the mixture of seed and manure is sown the same day they are mixed. If seed is mixed with manure, particularly superphosphate, some days before sowing the germination is very likely to be seriously damaged.

CONCLUSION.

In concluding this series of articles on pasture-establishment in New Zealand the writer feels that he has but touched on the fringe of the subject. More and more research work is needed before we can learn just exactly how our soils may be made to produce that wealth of grassland which is actually the chief support of this country. The writer will be content if the series has given the farmer some guidance for thought, for it is only by reflection and inquiry that the why and wherefore of things is made plain. Moreover, the reader should not be content to accept all that has been here written as incontrovertible fact, but should himself delve and probe into a subject which is of such prime utility and interest.

PROTECTION OF MARKS FOR AGRICULTURAL PRODUCTS.

A PROVISION which should assist producers in the protection of marks used by them on wool-bales and produce generally is embodied in the Patents, Designs, and Trade-marks Act, 1921–22. Formerly, many such marks actually in use were debarred from registration as not containing the constituents of a trade-mark within the meaning of the Act. In the 1921–22 Act, however, the Register of Trade-marks is divided into two sections: Part A consists of fully protected marks which comply with all the requirements of the Act as before, while Part B is open for entry of any trade-mark which for two years has been in *bona fide* use in New Zealand in connection with any goods for the purpose of indicating that they are the goods of the proprietor of the mark by virtue of manufacture, selection, certification, dealing with, or offering for sale. While not affording the full protection granted under Part A, registration of a trade-mark under Part B is *prima facie* evidence of the proprietor's right to the exclusive use of such mark, and any person charged with infringement must satisfy the Court that there was no intention to deceive or to lead to the belief that the goods marked were those of the owner of the trade-mark. Registration may be effected at the Patent Office, Wellington, or at any local Patent Office.

POWDERY MILDEW, PODOSPHAERA LEUCOTRICHA (E. AND E.) SALM.*

ITS APPEARANCE, CAUSE, AND CONTROL.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

POWDERY mildew although very frequently neglected by the orchardist is one of the most serious diseases with which he has to contend. It is prevalent throughout the fruitgrowing areas of New Zealand, and becomes especially troublesome during the late summer and the early autumn. It would appear that this disease originated in western North America, and from there it has spread to almost every country where apples are grown, for it has been recorded from Europe, Asia, and Australasia.

In New Zealand powdery mildew is confined to the apple, but in Japan it occurs on an additional host, *Pirus toringo*, and in North America has been recorded (though seldom) on the pear. So far as the writer is aware no apple varieties are immune, but certain varieties are more susceptible to attack than are others, Cox's Orange, Jonathan, Sturmer, Cleopatra, London Pippin, Gravenstein, and Northern Spy being usually severely infected.

ECONOMIC IMPORTANCE.

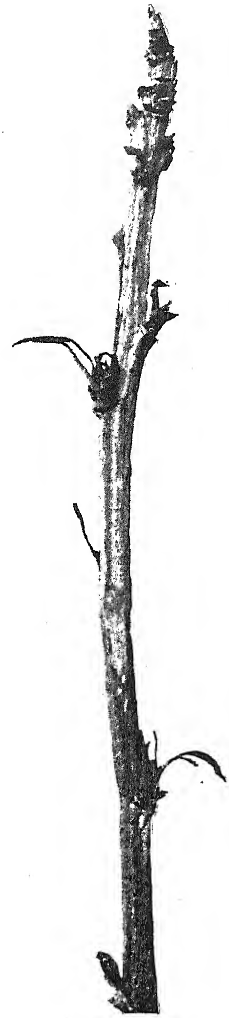
This disease causes the leaves to become much smaller in size, crinkled, brittle, and darker in colour. Infected leaves fall prematurely, so that about midsummer severely infected trees appear partially defoliated. Shoots, if infected early in the season, become stunted and often so weakened as to die at their tips, often losing their foliage, when they appear quite bare. Fruit-buds are damaged to such an extent that the resultant blossoms seldom set fruit. Fruits may be attacked while immature, with the result that at maturity they appear russeted and smaller than the normal. At the stem end they frequently become scabbed and cracked. In short, the effects of mildew infection are (1) the reduction of leafage and damage to the remaining foliage, (2) destruction of fruit-buds, (3) weakening and frequent killing of laterals, and (4) reduction of the marketable value of the fruit by russeting, cracking, and frequent deformation. Further, young nursery stock may be damaged to such an extent that wood-growth is entirely prevented; consequently such stock becomes unsaleable.

APPEARANCE AND EFFECT ON THE HOST.

Trees infected with powdery mildew present a very sickly appearance; they become partially defoliated, and carry about one-fourth of the leafage of a normal tree. The shoots are often bare at their tips (Fig. 2), and are partly covered with the glistening white masses of the fungus. The fruit is smaller than the normal, and usually disfigured.

* Synonyms: *Sphaerotheca leucotricha* Ell. and Ev.; *S. mali* Burr.; apple-mildew; mildew.

I



2

4

FIG. I. TIP OF A STURMER APPLE LATERAL ATTACKED BY THE POWDERY-MILDEW FUNGUS. HALF NATURAL SIZE.

Further growth is prevented, and the subsequently formed leaves remain small and strongly curled.

FIG. 2. INFECTED APPLE LATERAL FROM WHICH THE MATURE LEAVES HAVE FALLEN. SLIGHTLY REDUCED.

Note the stunted leaves, and especially the white mycelial mass covering the upper portion.

FIG. 4. DUNN'S FAVOURITE APPLE RUSSETED AS THE RESULT OF EARLY INFECTION. NATURAL SIZE.

Although not nöticeable, the near side is much deformed.

[*Photos by G. H. Cunningham.*

Powdery mildew attacks leaves, shoots, blossom-buds, and fruits. On the leaves it first becomes noticeable in the form of small, irregular, white or greyish cobwebby patches. These make their appearance first on the under-surface of the leaf, and gradually spread until both surfaces may become entirely covered, when the leaf appears as if covered with flour. Leaf-infection first occurs as soon as the leaves emerge from the bud, and the fungus spreads progressively from these to subsequently formed leaves. Infected leaves become narrower and rather longer than the normal. At first they appear somewhat blistered, then the edges gradually curl inwards until they appear markedly distorted (Fig. 1). Later they become brittle and have a scorched appearance. Finally they change to a bronze colour and ultimately fall away.

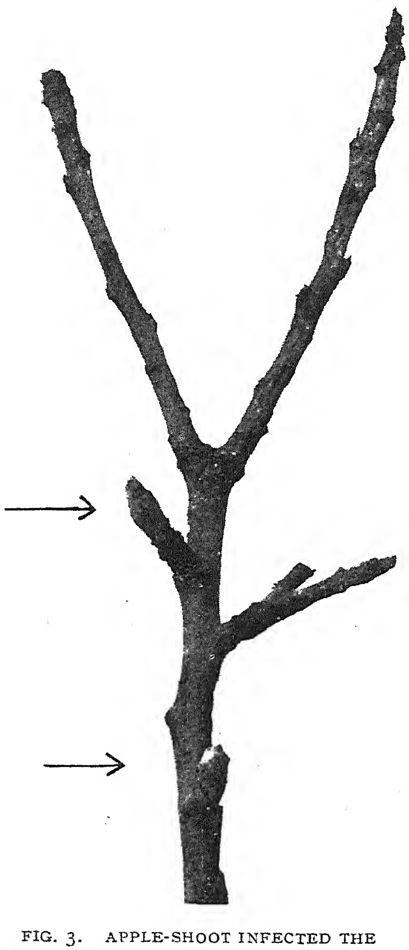


FIG. 3. APPLE-SHOOT INFECTED THE PREVIOUS SEASON. SLIGHTLY REDUCED.

Note the bunchiness of the laterals, their small size, and the closeness and small size of the buds. Normal buds indicated by arrows.

[*Photo by G. H. Cunningham.*

Laterals are infected shortly after the leaves have emerged from the buds and immediately after they have begun to increase in length. Infection occurs from the leaves, the hyphæ growing down the leaf-stalk (petioles) to the young shoots. As a result of infection growth is somewhat checked, consequently the buds are more closely set together (Fig. 3). When infection is severe the tips of the shoots are killed, and the following season several small shoots spring from below the killed area, the resultant shoots presenting a "bushy" appearance (Fig. 3). The fungus continues to develop on the shoots until they become covered with a white felt-like mass, more abundant near the tip, which consists of the mycelium or vegetative portion of the fungus (Fig. 2).

Infected blossom-buds are somewhat smaller than the normal, and are conspicuous by reason of their covering of white mycelium. When the buds expand and the blossoms appear, the calices and stalks are seen to be somewhat deformed and altered in colour. Infected blossoms rarely set fruit, and are invariably later in appearing than the normal blossoms.

The fruits are infected shortly after blossoming, and at this stage may be seen to be partially covered by the fungus. At this stage the delicate epidermis becomes damaged, so that later, when the fruits approach maturity, the epidermis is seen to be decidedly russeted, the markings appearing either as a delicate brown or yellowish tracery over the surface (Fig. 4), or as scabbed and deformed areas on one side, but more frequently on the stalk end of the fruit. This may be followed later by the appearance of concentric cracks which usually extend some distance into the flesh and afford opportunity for the entry of spores of soft-rot fungi; consequently fruit from trees infected with mildew rarely keeps well for any time. The writer has not observed the hyphæ of the fungus on other than very small fruits. The fruits of all varieties do not appear to be attacked, as russeting has not been observed on fruits of Cleopatra, although the leaves and shoots of this variety suffer severely.

LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

Powdery mildew is caused by *Podosphaera leucotricha*, a fungus having two spore stages in its life-cycle. The first or conidial stage is produced throughout the growing season on the felt-like masses of mycelium which cover the surfaces of infected leaves and shoots; the second or perithecial stage in New Zealand appears about the middle of March (although it would appear to be common in midsummer in North America) in the form of small black bodies (perithecia) partially embedded in the mycelial masses. The conidial stage is the more important one, as apparently the perithecia play little if any part in the perpetuation of the organism.

If a small portion of the felt-like mass of mycelium is examined under a microscope it is seen to consist of very numerous, colourless, closely woven threads (hyphæ) closely applied to the surface of the host (Fig. 5, *m*). From these at intervals arise upright stalks (conidiophores) (Fig. 5, *con*) bearing on their free ends chains of colourless oblong conidia (Fig. 5, *c*). These are produced in such enormous numbers as to give the leaves and shoots upon which they may happen to be growing the appearance of being covered with flour. Should one of these conidia be carried by wind or other agency to the surface of a growing leaf or shoot, and conditions prove favourable, it germinates and produces a slender germ-tube (hypha), which grows over the surface of the substratum, branching repeatedly to form a mycelium. This consists of very numerous interwoven hyphæ, and derives its nourishment from the epidermal cells, into which small branches (haustoria) penetrate (Fig. 5, *h*) to absorb therefrom the necessary food substances. It is thus seen that with the exception of these small haustoria all the fungus is superficial. The hyphæ continue to spread over leaves and shoots during the whole of the growing season.

About the middle of March the perithecia make their appearance on the shoots, leaves, and petioles, appearing as small, globose, black objects densely crowded together, and partially embedded in the mycelium (Fig. 7). Each perithecium has on its free surface several

bristle-like structures, which serve to characterize the species* (Fig. 7). Within the perithecium is a single large ascus containing eight one-celled, colourless ascospores (Fig. 7, III). Under humid conditions the perithecia absorb moisture and swell, and their walls become ruptured, allowing the ascospores to escape. Experiments carried out in North America (1914-18) would tend to show that the perithecia play little or no part in the perpetuation of the disease, as attempts made to infect young developing leaves with ascospores invariably failed.

The fungus is carried over from year to year by the felt-like masses of mycelium, which cover the buds, spurs, and tips of laterals, and by hyphæ which are enclosed within the scales of infected buds. This mycelium remains more or less dormant until the spring, when conidia are produced from the hyphæ, and these infect the leaves as they emerge from the buds, thus starting the disease afresh. Doubtless in many instances infection occurs from the hyphæ within the bud-scales, before the leaves emerge. It thus becomes apparent that the persistent mycelium is the source from which the fungus is spread in the spring; therefore in combating the disease the elimination of this mycelium should be attempted before any spray is applied.

CONSIDERATIONS REGARDING CONTROL.

As has just been shown, powdery mildew is perpetuated by the persistent mycelium (Fig. 2); therefore where systematic attempts are being made at control attention should be given to the removal of this source of infection. If all infected shoots and buds were removed, then the disease would be entirely eliminated and spraying unnecessary. Unfortunately, this cannot be accomplished in a commercial orchard, partly because the time required would be too great and the labour involved too costly, but principally because the disease is in part carried over in infected buds, which in many instances are not apparent from a casual inspection. Furthermore, infection would still be liable to occur from wind-borne spores from neglected orchards in the vicinity. Nevertheless, cutting out would minimize infection, especially spring infection, to such an extent that control by spraying would be rendered comparatively simple.

The crop would not be in any way lessened by the removal of infected shoots and fruit-buds, for, as has been shown earlier, infected buds are incapable of setting fruit. Therefore systematic control of powdery mildew must commence with the cutting-out of visibly infected material. This may be readily accomplished during the winter pruning, especially in New Zealand, where the system of pruning is such that practically every shoot is dealt with. If the disease were much in evidence during the late summer a further cutting-out could be undertaken.

From time to time numerous sprays have been recommended for mildew-control. Bordeaux, lime-sulphur, "iron-sulphide solution," atomic sulphur, and several variants of these have all been tried. Undoubtedly atomic sulphur has given the most satisfactory results.

* Recently the writer has obtained abundant perithecia from shoots of Sturmer collected at Ettrick, Otago. From the accompanying drawings it will be seen that the species in question is *Podosphaera leucotricha* (E. and E.) Salm. It is believed that the perithecia have not previously been recorded for Australasia.

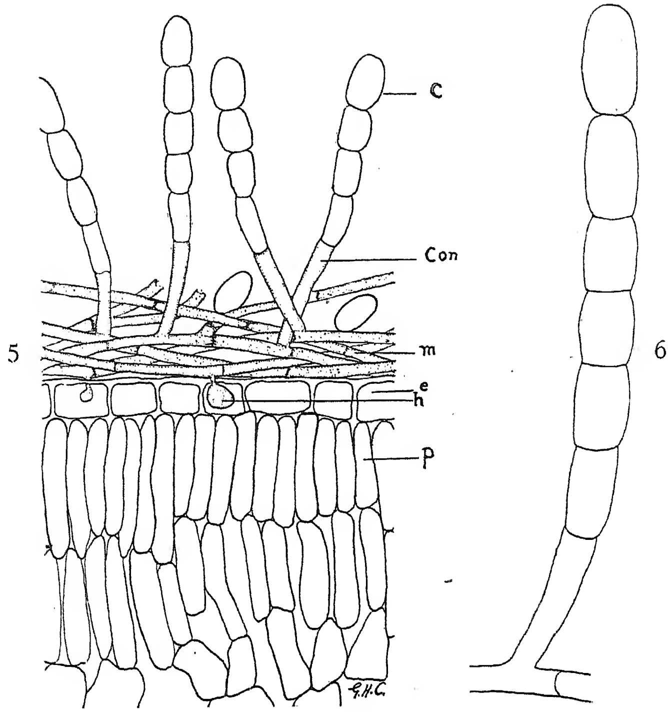


FIG. 5. SECTION THROUGH LEAF INFECTED WITH POWDERY MILDEW.

(*c*) Conidia; (*con*) conidiophores; (*e*) epidermis of the leaf; (*h*) haustorium; (*m*) hyphæ (collectively forming the mycelium); (*p*) palisade cells of the leaf, × 325.

FIG. 6. CONIDIOPHORE AND CHAIN OF CONIDIA, SHOWING METHOD OF SPORE PRODUCTION, × 600.

[*Original.*

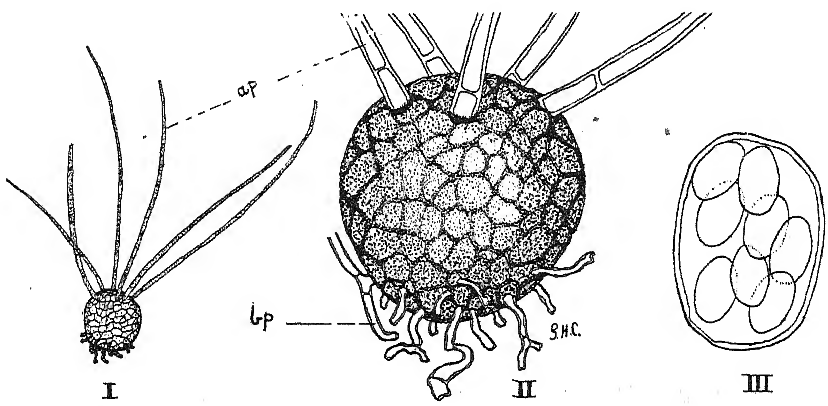


FIG. 7.

I. Perithecium of the fungus, × 85. II. Perithecium, × 330. Note the apical (*ap*) and basal (*bp*) appendages. III. Ascus and ascospores, × 330.

[*Original.*

The iron sulphide solution has been favoured by numerous growers (this is a solution of lime-sulphur to which iron sulphate ($FeSO_4$) has been added), but consideration will show that this is merely a solution of atomic sulphur and iron sulphide (FeS), the latter compound possessing little if any value as a fungicide.

CONTROL.

(J. A. Campbell, Director of the Horticulture Division, Wellington.)

As powdery mildew is carried over the winter months by the patches of fungus which remain on the shoots and in the bud-scales, it is necessary that as many of these as are seen be removed during the winter pruning. This should be followed by spray applications according to the following schedule:—

No.	Time of Application.	Spray.
1	Between open-cluster and pink stage	*3–4–50 bordeaux, or preferably 1–30 lime-sulphur.
2†	Calyx (petal-fall, or when the majority of the petals have fallen)	1–100 to 1–120 lime-sulphur, or preferably 10–100 atomic sulphur.
3	Beginning of January	10–100 atomic sulphur, or 1–120 lime-sulphur.
4	Middle of February	10–100 atomic sulphur, or 1–100 lime-sulphur.

* Bordeaux is not as efficient a spray for mildew as any of the sulphur preparations, so that where black-spot is absent (as in Central Otago) it is better to use lime-sulphur, 1–30, at this stage.

† With this and subsequent sprays arsenate of lead, 3 lb. paste or 1½ lb. powder to 100 gallons, may be added for the control of codlin-moth and leaf-roller caterpillar.

Where a regular spray formula for black-spot control is being followed it will be found that mildew is held in check somewhat, but not entirely, as lime-sulphur is not altogether satisfactory as a controllant of mildew owing to the very weak strength (1–120) at which it is applied. A dual spray—lime-sulphur 1–120 + atomic sulphur, 10–100—is therefore recommended in place of lime-sulphur alone. The second black-spot spray would be lime-sulphur, 1–30, in preference to bordeaux, 3–4–50, as the latter is not as efficient a mildew controllant as the former.

The first two sprays in the schedule prevent leaf-infection from mycelium overwintering in the buds, No. 2 especially preventing russeting of fruits. The third and fourth sprays prevent infection from outside sources. It should be realized, however, that spraying is effective only where cutting-out has been practised in the winter. No. 3 spray should be followed by cutting-out, especially where the disease is prevalent.

SUMMARY.

(1.) Powdery mildew is a fungous disease attacking leaves, shoots, buds, and fruits. It occurs on apple, pear, and (in Japan) *Pirus toringo*.

(2.) The name of the fungus is *Podosphaeria leucotricha*, as has been definitely established by the recent finding of abundant perithecia.

(3.) The disease overwinters by means of resting mycelium on the shoots and in the bud-scales. It is spread in summer by means of conidia produced from mycelium covering leaves and shoots.

(4.) It may be controlled by the systematic cutting-out of infected shoots and buds during the winter pruning, and by spraying according to the foregoing schedule.

(5.) Atomic sulphur, 10 lb. to 100 gallons of water, is the most efficient fungicide to use as a controllant.

LITERATURE CONSULTED.

BALLARD, W. S., and VOICK, W. H., 1914. Apple Powdery Mildew and its Control in the Pajaro Valley. *U.S. Dept. Agri. Bull. 120*, pp. 1–26.

FISHER, D. F., 1918. Apple Powdery Mildew and its Control in the Arid Regions of the Pacific North-west. *U.S. Dept. Agri. Bull. 712*, pp. 1–28.

SALMON, E. S., 1900. *A Monograph of the Erysiphaceae*, pp. 40–44. New York.

HERD-TESTING.

WHY AGGREGATE ASSOCIATION RECORDS ARE HIGHER THAN FACTORY RETURNS.

W. G. BATT, Farm Dairy Instructor, Taumarunui.

HERD-TESTING association members often ask why association records, as a rule, show a greater aggregate amount of butterfat than the actual factory returns, and in this article an endeavour is made to outline some of the chief causes of the difference. In the first place it may be pointed out that the comparison in question is totally unfair, and rather tends to show a lack of understanding of the working of the system on the part of the farmer concerned. When one considers that the association records are the result of an average taken from two days' production in every thirty, and that conditions are all in favour of this being on the high side, it is no surprise that the figures recorded are often greater than the actual return. It must be understood, however, that this can make no difference to the value of such figures in culling, as they must be taken on a comparative basis, which, providing each cow receives the same treatment, is of value even if the records are considerably higher than the amount of butterfat actually produced. This has been amply demonstrated, and I have no hesitation in asserting that the association figures provide a safe and reliable basis for culling.

CAUSES OF DISCREPANCY.

Some of the causes of the discrepancy referred to are as follows :—

Milk fed to calves and used by household : In the early part of the season this is fairly considerable, and takes a material amount of fat away from the factory returns while being credited to the association records. There is in this way a difference set up between the two returns more or less throughout the season.

Loss of fat in separation: In some cases this loss is considerable, and in all cases there is some. I would suggest to all farmers the advisability of having separated milk tested at intervals during the year.

Loss of fat in transit of cream: In some cases this also is considerable, especially where the cream supplied is of a thin consistency and churns in transit to the factory.

Cream used for buttermaking on the farm: Where this is the practice a considerable difference is made between the two returns—to the credit of the association and debit of the factory return.

Carelessness in sampling: Care in this direction is very important if the work is to be well done, and the milk must be thoroughly stirred before sampling. Discrepancies also occur in connection with damage received by samples in transit to the factory. Occasionally farmers check or think they are checking this class of testing by placing the milk from one cow in two or more bottles, again showing how little farmers in general know of the damage samples may receive in transit, the necessity for careful sampling, and the consistency of milk and its relation to testing. The butterfat in milk is suspended in the serum in the shape of small globules, and this suspension is often broken by the shaking samples receive in transit, especially in hot weather, when milk expands. Once this happens the fat floats on the top of the serum as an oil, and usually it is difficult to make a correct test. Other variations in the test of two samples of the same milk may occur in the leakage of fat in transit, the absorption of fat in corks, the churning of samples on their way to the factory, and irregular and careless sampling on the farm.

Variations in general conditions: Factory returns embody all variations in weather conditions, feeding-conditions, and weights of milk and tests, while the association records as a rule are not so handicapped. This is usually the main cause of the difference between the two returns. The factory has to take all these variations as they come, while, generally speaking, the association records are affected by only a comparatively small proportion, owing to the latter samples being taken on only two days in the month, as compared with thirty in the case of the factory. It is well known that cows (especially those of a nervous temperament) will rise and fall in their tests from day to day to a very great extent. This also applies to the milk-flow—in some cases a change of milker or feed or weather conditions being sufficient to cause a large variation in production. This being the case, it is not surprising that in some periods the figures may be very much in favour of the association. This is the more likely seeing that most farmers appear to wait for good weather and feeding conditions before taking their two days' samples for the association.

Sampling not representative: A fully representative sample can only be obtained when the weights of milk are the same for each sampling, unless the size of the sample is varied according to the variation in the weight of milk. This, again, is usually in favour of the association. The milking-hours on most farms are so arranged that cows produce more milk at the morning than at the evening milking, and most cows show a greater percentage of butterfat at the evening milking than in the morning. This means that where

the same amount of milk is sampled from each milking, and the weight of milk differs, the test received will usually be higher than it should be, owing to a proportionately greater amount being taken from the higher-testing evening milk.

Variations from normal in the milk: Allowance must, of course, be made for these variations, especially when the tests are rising. They are usually in favour of the association returns.

Retrospective records: Providing the cow has been in milk less than one hundred days of the end of the period in which she was first tested, the association record is made retrospective to calving-date. This means that a cow calving in the late winter and being tested for the first time in the spring, when there was a good flush of milk, would get more fat to her credit for that period than she had actually produced. This can be overcome by commencing the test of each cow as soon as possible after she calves, and it is important that this should be done.

THE SOUND BASIS FOR CULLING.

When judging the merits of individual cows for factory dairying, it is necessary to do so on their butterfat production for the season, not on the quantity of milk produced, and not on the test. The latter is only the percentage of fat in a given quantity of milk, and is likely to fluctuate considerably. Farmers very often make the mistake of judging cows on their tests, and as this is usually misleading good cows have sometimes been culled while poor ones were retained in the herd. A sound basis and an accurate conclusion on which to cull can only be obtained by taking the amount of butterfat produced by the cow for the season, in conjunction with her age and the number of days she has been in milk. When this is done, and the causes of discrepancy just enumerated are appreciated, farmers will realize that if they do their part of the work conscientiously the association will do its part towards providing a safe and reliable basis for culling.

THE FIELDS DIVISION.

THE Fields Division of the Department has been reconstituted as from 1st May, with Mr. A. H. Cockayne as Director. The Division incorporates the following branches: The Biological Laboratory (including the seed-testing station); the Agricultural Instruction Service; experimental and demonstrational areas (not including at present the Ruakura, Weraroa, and Moumahaki Farms); the Hemp-grading Service; and the Grain-grading Service. Under the Director, Mr. R. Waters has been appointed Officer in Charge of the Biological Laboratory.

Importation of Game Birds.—An application by the Auckland Acclimatization Society for permission to import Virginian quail was further considered by the Board of Agriculture last month. The Board decided that it could not support the request in view of the many complaints which had reached it as to the damage now being done by quail in the Auckland District. A further application by the same society to import from England a small number of Mongolian pheasants and black-necked pheasants was recommended for favourable consideration, as was also the request of the Southland Acclimatization Society for permission to capture quail in the Lakes Acclimatization District for liberation in the Southland District.

THE BEST STAGE FOR CUTTING WHEAT.

EXPERIMENT UNDER THE STATISTICAL METHOD AT LINCOLN.*

F. W. HILGENDORF, D.Sc., and J. W. CALDER, B.Agr., Canterbury Agricultural College, Lincoln.

If wheat is cut too early it shrivels, and if cut too late there is a risk that grain will be lost by shaking. The question that has to be answered many times each harvest, therefore, is, "How soon can the wheat be cut without losing weight by shrivelling?"

To answer this question by a definite experiment had long been in mind, but it seemed difficult to arrange. If one were to take the yields of adjacent plots cut early and late, the mere removal of its neighbour would give the late-cut plot an advantage; and if the plots were taken large enough to obviate this difficulty they might run into different soils, and so would need numerous repetitions to correct the variations due to this cause. So the question was left as requiring more time than was then available.

Some time before last harvest, however, it occurred to one of us that it may confidently be taken for granted that no new grains of wheat can be formed during the last fortnight before maturity, and consequently that the weight of, say, 100 grains of the early and late-cut crops would be an accurate reflex of their final yields. An experiment was therefore arranged on these lines. An even crop of Solid-straw Tuscan was taken, and a block 14 yards by 11 yards was marked out therein. Strings were run lengthwise and across the block at each yard, so that 154 plots, each 1 yard square, were marked out. Since it was designed to cut the wheat at five different stages, the plots were named A1, B1, C1, D1, E1; A2, B2, C2, &c., so that there were thirty or thirty-one plots bearing each naming letter, and each letter was distributed evenly over the block.

When it was judged that the crop was about a fortnight from maturity cutting commenced, twelve straws being cut from the middle of each of the square yards named A1, A2, A3, &c. The straws cut were always adjacent, they were cut without looking at their heads to see if large or small, and were all cut at ground-level. Just before cutting elaborate notes were taken as to the stage of ripeness that the crop had reached, and after cutting each bundle of twelve straws was tied and labelled and hung up indoors to harden and dry.

After three days new observations were taken, and twelve straws were similarly cut and tied from each of the thirty-one plots marked B; and so on at three-day intervals until plots E were cut, twelve days after the cutting of plots A. The first cutting was made while the

* This article is of note as recording what is probably the first application of the "method of statistics" and the "theory of probability" to an agricultural experiment in New Zealand. The system has been increasingly adopted of late in experimental work in Britain.—EDITOR.

general aspect of the crop was still decidedly green, and the last one when about half a bushel of grain per acre had been shaken on to the ground, so that the various cuttings embraced the whole period during which any one would be likely to harvest a crop on a farming scale. Complications possibly arising from differences in weather after cutting were reckoned with in a subsidiary experiment. The actual stage of maturity at which each cutting was made will be described later.

Before proceeding to state the weights of the 100 grains cut at the various stages, it is perhaps necessary to explain why so large a number as thirty plots were taken from which to cut representative straws at each stage. It was because of the generally unsatisfactory nature of averages as commonly determined in agricultural experiments. An average alone gives a scanty amount of information. "An average of 20" may mean that there were 100 observations between 19 and 21, with a mean of 20; or it may mean that there were two observations of 1 and 39. Again, in tossing 20 coins 20 times we may find that an average of 9 heads will turn up—a result that is obviously not strictly reliable. Therefore mathematicians have invented a device to indicate the reliability of any average. They add to the figure indicating the mean another figure indicating what is called the "probable error." Thus, if an average is stated to be 20 ± 1 the 1 is called the probable error, meaning that if another average were computed with equal care the chances would be even that the new average would be between 19 and 21, or outside these limits. Not the clearest of indications, one might think, but one that becomes quite easily understandable with use. It is clear that the smaller the probable error the more reliable the average.

Returning to the Lincoln experiment, the twelve heads of each of the thirty A plots and the twelve from each of the thirty B plots, &c., were hung up for a couple of months until they were all dry, and assumed to have the same water content—an assumption that was checked and found correct later on. They were all threshed on the one day, and from each of the 154 lots 100 grains were counted and weighed within two days. The averages with their probable errors were as follows:—

Average Weight (from thirty or thirty-one Plots) of 100 Grains of Solid-straw Tuscan Wheat cut at Three-day Intervals.

Stage A (the earliest)	.. ..	4·047 ± 0·024 grammes.
,, B cut three days later	..	4·060 ± 0·026 ,,
,, C ,,	..	4·299 ± 0·028 ,,
,, D ,,	..	4·269 ± 0·032 ,,
,, E ,,	..	4·299 ± 0·045 ,,

These figures are of considerable interest. The smallness of the probable errors (0·5 to 1·0 per cent. of the averages) is satisfactory proof that the weighings were accurate and their number sufficient, but no explanation occurs to us of their gradual increase with the advance in the date of cutting. There is a general similarity between the A and B cuttings, then a distinct break between B and C, and then a similarity between C, D, and E. The variations between the last three—*i.e.*, the falling-away at D to less than C or E—might

occasion some concern at first, until the meaning of "probable error" is recalled. The weight of C is 4·299 ± 0·028 grammes—*i.e.*, it is equally likely to be between 4·271 grammes and 4·327 grammes or outside these limits. At the same time the weight of D is 4·269 ± 0·032 grammes—*i.e.*, it is equally likely to be between 4·238 grammes and 4·301 grammes or outside these limits. Thus the lower limit of C (4·271 grammes) is much lower than the upper limit of D (4·301)—that is, the two overlap—so that there is no real difference between C and D, but only a difference caused by the special set of samples here used to compute the means. Such a difference is said to be "non-significant"—*i.e.*, it does not signify any real difference.

Mathematicians have computed from their study of probability that any difference less than three times the probable error of that difference has only a 20-to-1 chance of being a real difference—that is, one not caused by mere fluctuations of sampling. Thus, on comparing averages, the probable errors of the differences are of great importance. They have been calculated for the present set of figures as follows:—

Difference between	A and B	= 0·023 ± 0·035	grammes.
,,	B and C	= 0·239 ± 0·038	,,
,,	C and D	= 0·030 ± 0·042	,,
,,	D and E	= 0·030 ± 0·055	,,

Thus, the differences between A and B, C and D, and D and E are less than the probable errors of these differences, and so are non-significant. Therefore we cannot say that there is any difference in weight between grain cut at stages A and B and between those cut at stages C, D, and E. On the other hand, the difference between B and C (0·239 grammes) is 6·3 times the probable error of the difference, 0·038. This is the outstanding fact of the investigation, and consultation of tables of probabilities shows that the chances are 25,000 to 1 that such a difference is significant—odds that most of us would be willing to accept as certainty. Thus we conclude that if we cut at stage C there are 25,000 chances to 1 that we will get a higher yield than cutting at stage B, but that if we wait longer no increased weight need be anticipated.

Two more points must be mentioned. Firstly, a further calculation will enable us to estimate the gain obtained by waiting from stage B to stage C as 2·5 bushels per cent., or exactly 1 bushel per acre on a 40-bushel crop—the probability of at least this gain occurring being 40 to 1, which may be taken as practical certainty. Secondly, we may now define the degree of maturity to which the crops had attained at the critical stage C, cutting before which results in a loss of weight, and cutting after which results in no gain. The stage will be more closely defined by describing those before and after it as follows:—

Stage B, second cutting: General aspect of crop—nearly ripe-coloured, in some patches nearly all green has disappeared. Straw—practically all straws now yellow, but a few still green just below the head and just above top knot. Heads—one-third still green and two-thirds white or turning white. Grain—that in white heads when squeezed between the fingers produced a dry dough. (This stage proved too early to cut profitably).

Stage C, third cutting, three days after B: General aspect of crop—ripe-coloured, but close scrutiny showed green tinge. Straw—all yellow except about 1 per cent., which showed 3 in. of green above the top knot; all knots green. Heads—ripe-coloured except about 1 per cent. still green. Grain—that in ripe heads would not squeeze out any kind of dough, but cut easily with thumb-nail. (This proved the earliest stage at which cutting meant no loss of weight.)

Stage D, fourth cutting, three days after C: General aspect—quite ready to cut, a slightly green head and stalk being found only after close search. Straw—nearly all ripe to the head, but about 5 per cent. still yellow below head. Knots—most knots still green, but about 25 per cent. half brown and a few quite brown. Heads—all ripe. Grain—will not squeeze but will still cut with thumb-nail. (No gain in weight resulted from leaving the crop till this stage.)

SUMMARY AND CONCLUSION.

A crop of wheat was cut at five different stages of ripeness at three-day intervals, and thirty plots were cut at each stage so as to reduce the experimental error of the average. The relative crops at various cuttings were computed by weighing 100 grains of each of the thirty plots cut at each stage. A calculation of probabilities showed 25,000 chances to 1 that an increased weight was securable by waiting till stage C, and that there was no further gain but only risk of loss by waiting longer. There is a 40-to-1 chance—*i.e.*, a practical certainty—that the gain from waiting till stage C is 1 bushel per acre on a 40-bushel crop.

Stage C is thus shortly defined: The green has been replaced by yellow in the top internode of 99 per cent. of the straws; all knots are still green; no dough can be squeezed out from the grain, but the grain is still soft enough to cut with the thumb-nail.

Raising Cherry-plum and Olearia Forsteri *for Hedge Purposes.*—Both these plants root quite freely from cuttings if properly inserted in suitable soil. It would be in nearly all cases useless to plant the cuttings in a hedge-row, as conditions suitable for rooting are rarely obtainable. For the cuttings select a plot of good friable soil where the drainage is good. Dig or deeply plough the soil, throwing aside any bulky weeds there may be, as these will not have time to rot down before the cuttings are put in. When planting the cuttings dig with a spade till there is room for a row; then stretch a line where the first row is to go. Make a trench in front of the line by inserting the spade, held quite upright, against the line and dragging the soil forward. The trench will require to be of a depth to suit the length of the cuttings, which may be placed with about two-thirds of their length in the ground. Place a row of cuttings in position, and then push some soil against them and tread it firm. Finish by digging to the row of cuttings, leaving the surface soil loose, until there is room for another row, then bring the line forward and continue as before. The plants will be ready for setting out in hedge-rows the following year.

Cherry-plum cuttings may be 12 in. to 15 in. long, and should be made from straight pieces of young wood, not thin spray. Make and plant them as soon as possible after the leaves fall, placing them about 3 in. apart. For cuttings of *Olearia Forsteri* take the ends of branches cut about 12 in. long, trim the soft tops off, cut the base square across just under a joint, and trim off side growths so as to leave a head with two or more branches. Insert so that the heads just touch each other in the row. These cuttings may be put in at any time up to the middle of August. To facilitate rooting and after-growth, the space between the rows of cuttings should be kept free of weeds and the surface frequently loosened.
—*Horticulture Division.*

REGRASSING EXPERIMENTS ON CANTERBURY BACK-COUNTRY.

F. E. WARD, Instructor in Agriculture, Christchurch.

SEVERAL factors have no doubt played a part in bringing about the condition of denudation which extends over thousands of acres of good sheep-country in the Mackenzie district. Among the chief causes of depletion are severe climatic conditions—hot north-west winds in summer with heavy and continuous frosts in winter; overstocking with sheep and rabbits; and conditions of tenure which have not encouraged the occupiers to improve their holdings.

In the spring of 1921 the Agricultural Instruction Branch of the Department, in co-operation with Canterbury College, undertook experimental sowings to ascertain whether or not these areas could be regrassed by surface-sowing, or with the aid of such agricultural operations as could be applied in a practical manner over large areas. The Department already had two wire-netted areas on which experimental sowings of grass had been made a number of years previously. Numerous species had been tried, and the plots gave a useful guide as to what grasses were likely to establish if sowings were made on selected areas not protected by wire netting.

In planning the sowings now dealt with, three aspects were taken into consideration: (1) Flat ground exposed to wind, (2) sunny faces, and (3) dark faces. The sowings were made in the spring of 1921, autumn of 1922, and spring of 1922. The grasses used in the spring of 1921 were cocksfoot, heath mixture (Yorkshire fog, white clover, and rye-grass), yarrow, tall fescue, white clover, sheep's burnet, Grimm lucerne, tall oat-grass, Poa pratensis, and fiorin. The sowings made on the flat ground exposed to wind germinated and dried off, and resulted in no take of grass. Those made on sunny faces were also very poor and practically useless, except where soil conditions were favourable enough to support a weak strike.

The results on the dark faces were most encouraging. The first sowings (6th September, 1921) were inspected in March, 1922, when a satisfactory strike was noticed, but all plants were small and tender, and it was problematical whether or not they would be lifted out by frost during the advancing winter. When again inspected on 7th September, 1922, it was found that practically all the plants had wintered well, and quite a green tinge was noticeable on what had hitherto been a dark-brown face. The portion here referred to was Gallows Hill, on Haldon Station, the altitude of the latter being about 1,200 ft. The top of the hill, some 300 ft. above the surrounding flat country, is rocky, but it was among the rocks that the grass appeared to be doing particularly well. The hill was stocked with sheep from time to time, but not heavily in the early stages.

A further inspection was made on 23rd February, 1923, when it was found that the hill had been heavily stocked with both sheep and

rabbits. The grass showed evidence of having been closely eaten, but not to any extent pulled out. Yorkshire fog had established strongly, and though despised in low-country pastures it is quite accepted in the country under notice. Cocksfoot, which had wintered well, was now showing signs of depreciation under the dry summer weather, and many plants secured at this time by a weak roothold were in grave danger of being pulled out by sheep. With due consideration to the amount of seed sown, the grasses present in order of abundance were: Very numerous—Yorkshire fog, cocksfoot, yarrow, rye-grass; Rarer—white clover, sheep's burnet, goose-grass, and Poa pratensis; rare—lucerne, tall oat-grass; practically none—fiorin and tall fescue. A few plants of fog, cocksfoot, rye-grass, and goose-grass in sheltered positions had seed-heads.

FIG. I. SURFACE-SOWING ON GALLOWS HILL.

Showing good take of grass on rocky ground. Heavily stocked with sheep and rabbits. Sown 6/9/21; photo taken 23/2/23.

[*Photo by F. E. Ward.*

In a wire-netted area having a northerly aspect eight one-acre plots were sown, each plot having a different predominating constituent. There were two main objects in view with these sowings—firstly to ascertain if a quantitative sowing of the various constituents played any important part in regrassing such country, and secondly to note whether chain-harrowing had an advantage over surface-sowing without artificial means of covering the seed.

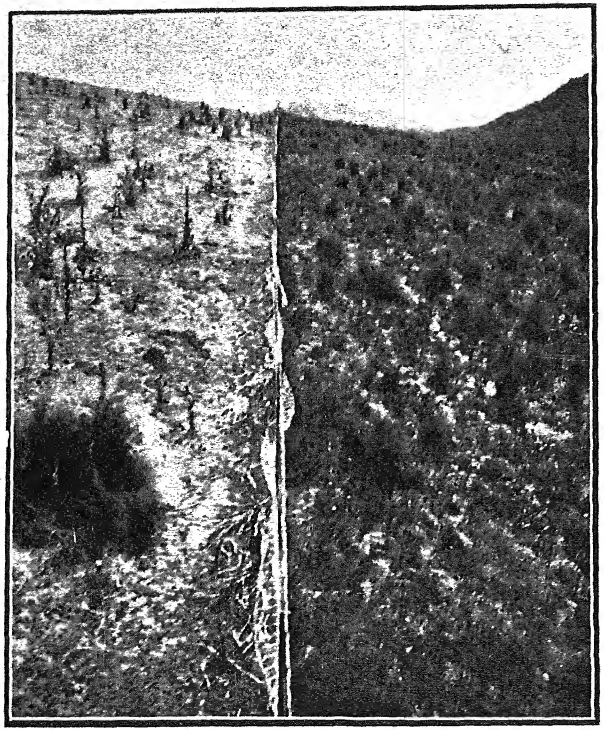


FIG. 2. VIEW ON FENCE-LINE DIVIDING THE HALDON NETTED AREA FROM EXPOSED GROUND, LOOKING WEST.

Note surface cover in netted area on right. Fence erected in 1910.

FIG. 3. VIEW OF PLOT IN NETTED AREA, HALDON.

Grasses, ungrazed, growing tall and straight. Sown 6/9/21, and seed covered with chain harrows. Photo taken 23/2/23.

[Photos by F. E. Ward.

At date of writing one cannot see any appreciable advantage in quantitative sowings. Owing to the very dry local conditions plants require a good deal of soil-space, and when the seed is thickly sown the death-rate is great and a thin strike results. It cannot yet be stated that any one plot excels the others, but the grasses most in evidence are the same species as those already mentioned as doing well on Gallows Hill. The same grasses were sown in the area as outside, with the addition of Chewings fescue and chicory. Owing to there being no stock in the netted area, the grasses when inspected in March, 1923 (sown 6th September, 1921), were tall and straight in habit of growth, but very little evidence was present of their seeding. Here cocksfoot, yarrow, tall fescue, and chicory were very noticeable, the

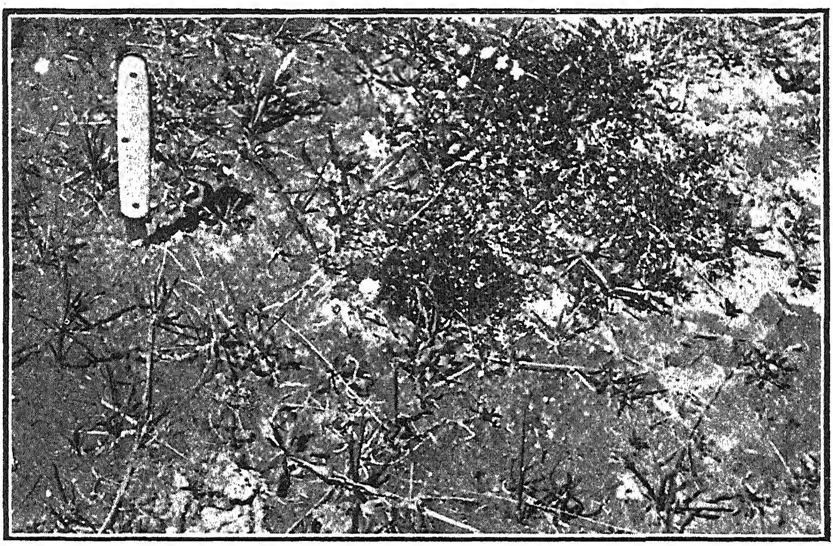


FIG. 4. GRASS-SEEDLINGS ON EXPOSED GROUND, MOUNT POSSESSION.
Sown 13/9/22; photo taken 31/1/23.

last-named having seeded fairly freely. The chain-harrowing to give cover to the seed seemed quite unnecessary—in fact, appeared to cover the seed too deeply in many places. The frost-cracked ground, with a shower of rain after spring sowing, gave the most satisfactory results.

Somewhat similar sowings were made on Mount Possession Station, Ashburton County, where the rainfall is somewhat heavier than at Haldon, but the land probably of poorer quality. Here flat and undulating country was selected (altitude approximately 2,000 ft.), and sowings made both in autumn and spring. The autumn sowings confirmed the Mackenzie country experience, and were quite useless. The spring-sown seed gave a fairly good strike, particularly on the southerly aspects or where protected from the north-west wind. As far as present observations go, bare ground proved a more acceptable seed-bed than that covered with vegetative growth, such as scab-weeds, *Triodia australis*, Strathmore weed, a yellow composite, New

Zealand bluebell, native willow-weed, &c. On the flat ground the tussocks (*Poa caespitosa* and *Festuca novae-zelandiae*) afforded shelter, and the seedlings were better and stronger than those in the open.

The general conclusions drawn so far are,—

(1.) Spring is the best time to sow.

(2.) Frost-cracked bare ground with a southerly aspect affords the best chance of a strike.

(3.) The regrassing of these positions should be attempted before the sunny faces or those positions exposed to the north-west winds.

(4.) The grass species mentioned are suitable for the purpose. The introduction of grasses from other countries having similar climatic conditions should have useful results.

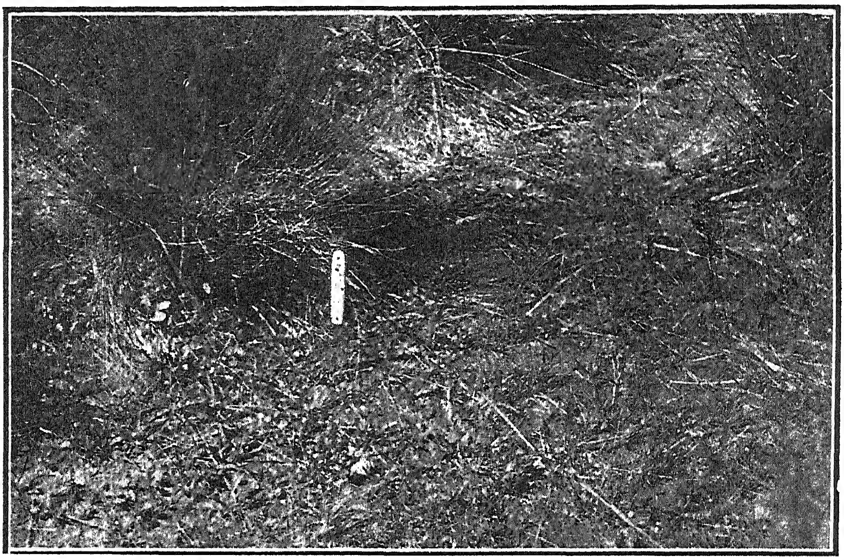


FIG. 5. SHOWING GRASS-SEEDLINGS GROWING IN SHELTER OF TUSSOCKS ON SORRELLY GROUND, MOUNT POSSESSION.

Sown 13/9/22; photo taken 31/1/23.

[*Photos by F. E. Ward.*

Four grasses have been introduced from South Africa and four from Queensland, and these will be sown next spring. The South African species are *Ischaemum glauchtachigum, Pennisetum cinroides, Panicum maximum,* and *Panicum laevifolium.* The Queensland grasses are *Eriochloa annulata, Setaria glauca,* and two samples of *Panicum* tussock-grasses. Australian spiked blue-grass (*Agropyron pectinatum*) was evidently introduced into the Mackenzie country by the wool of rams imported from Australia, and it is spreading rather rapidly, even on the sunny faces.

Thanks are due to Messrs. James Inness (Haldon Station) and James Grant (Gray's Hill Station) for their valuable assistance, which facilitated the carrying-out of this work. The co-operation and assistance of Mr. M. Dalziel, supervisor of the Canterbury College reserves, is also cordially acknowledged.

IMPROVEMENT OF PHORMIUM TENAX FOR THE FIBRE INDUSTRY.

INVESTIGATIONS AT MIRANUI.

G. SMERLE, Miranui, Shannon.

THE writer was appointed by the New Zealand Flax-millers' Association in November, 1921, to carry out investigations into the so-called yellow-leaf disease of *Phormium tenax*, with the object of discovering its cause and finding means of combating it. The scope of the work also included improvement of the existing poor condition generally of phormium,* and the breeding of plants immune to the disease. The investigation was centred at the Miranui mill and phormium areas of the Seifert Company, near Shannon.

When commencing the work I realized that to achieve some immediate result it would be necessary to concentrate on ascertaining the factors which give rise to the disease, rather than to discover its actual causal agent. By working on this line, I became of opinion that there are at least three factors which prepare the way for the disease—namely, (1) the common method of cutting the phormium-plant, (2) the grazing of cattle in the phormium areas, and (3) the presence of weed-growth among the plants. As the investigation has progressed, however, so has the field for research broadened, and we now realize that combating the yellow-leaf disease is but one of the ameliorative measures to be undertaken.

Work of prime importance for the future of the industry is the selection and breeding of the very best varieties of phormium—varieties which will produce the greatest quantity of fibre of the highest quality. We now know that there are great differences in the varieties of phormium, the fibre yield of some of the best being twice as valuable as that from the average. This comparison is based on the varieties already tested; there may be some even more valuable. It is therefore most important to test every variety.

FACTORS INDUCING YELLOW-LEAF DISEASE.

Faulty Cutting of the Plant.—Examining the four factors which induce yellow-leaf disease, it is found that the present ordinary method of cutting the plant is the most important. That method consists in chopping down all the fans 5 in. to 10 in. above the ground. As the cutters are paid by the weight they cut, and the butts of the leaves are the heaviest part, they naturally try to cut as low as possible, the only restraint being that the butts must not show too much of what is colloquially termed "rhubarb." The butt ends of the leaves are of a rhubarb colour, and if there are long ends

* The term "phormium" instead of "flax" is used throughout this article, in conformity with recent practice in the *Journal.*

with that colour it discolours the fibre when stripping: discoloured fibre is graded lower than a good white fibre.

The present method of cutting was adopted owing to its cheapness. The effect upon the plant was never considered. Why the present method of cutting is so detrimental to the plant's growth is because cutting all the leaf low to the root causes a large injured surface—a severe wound shock—and deprives the plant of all its green leaves, without which it cannot assimilate carbonic-acid gas and convert it into starch-sugar When the growth of such a low-cut plant is observed one notices a creamy white centre leaf coming up in the stump of the fan. After a day or two the first day's growth becomes greenish and subsequently quite green, but for a considerable time after cutting one can count by the day's growth (which is green) and the night's growth (which is white) how long a time the phormium has been cut. The markings are quite distinct, and I have by this means counted as many as twenty-six days' growth in summer-time. The plant can produce the green colouring-matter called "chlorophyll" in light only, and hence the green and white markings in the new leaves. As the plant has to obtain from the root-system all the nourishment necessary for its growth until sufficient green leaves have grown to obtain adequate nourishment from the air, the root-system is weakened, and yellow-leaf being a root-disease this method of cutting encourages it greatly.

Cutting away all the leaf not only makes the root-system subject to disease, but also encourages all possible leaf-diseases on the new pale-green leaves. These have no bloom (the waxy matter on the epidermis) to protect them, as old leaves have. Altogether the present method of cutting is very detrimental to the growth of the plant, and the sooner it is abolished the better it will be for the fibre industry.

Grazing of Cattle.—The grazing of cattle among phormium is also detrimental to the plant's growth, because the cattle chew the leaves and pull out the centre leaf, which delays the growth of new leaves from three to four months. The constant jerking of the leaf while the animal is chewing tends to injure the tips of the embryo fans in the sheath, and in consequence they become affected by diseases and never come up. The function of the gum in the plant is to lubricate the sheath, but that does not protect all the embryo fans from being wounded by the constant jerking. It is known to all experienced workers that phormium does not thicken up where cattle are grazed, although they usually are not aware of the cause of this.

Weed-growth.—A growth of weeds among phormium crowds the plant and absorbs the light and air which it would utilize for its better development. I have compared the fibre-content of plants grown close to a fly-line* in the open with that of plants of the same variety grown in the shade of willow-trees. The plants which grew in the open produced over 16 per cent. of finished fibre, while those which grew in the shade produced only 12 per cent. Moreover, weeds interfere with the cutting of the leaf, and so increase the cost of that operation, and they also occupy land where phormium could grow.

* Fly-lines are 6-ft.-wide cleared tracks through the phormium, upon which tram-lines are laid to carry out the cut leaf.

SELECTION AND BREEDING-WORK.

Besides studying the factors which are detrimental to the growth of the phormium-plant I also selected in the Miranui and Whitaunui Swamps over eight hundred apparently healthy plants for the purpose of observing their growth and disease-resistance, also to obtain seed from the healthiest-looking individuals in the most diseased areas. For this work a nursery area of about 4 acres was measured and fenced off. About an acre of this is on a fairly high terrace; the remainder of the area comprises the terrace slope and a low-lying swampy area. The nursery is situated close to the main road between Palmerston North and Wellington, about two miles north of Shannon. The portion on the top of the terrace is subdivided into twenty plots. Some of the plots were manured with different fertilizers or a mixture of fertilizers, and some were left without any manure, as checks.

The phormium-seed was sown at intervals of a month, in order to ascertain the best time for sowing. As the land was not ready

FIG. I. THE NURSERY AREA AT MIRANUI.

[*Photo by H. A. Seifert.*

in March a small plot was sown below the Miranui mill. In the nursery, plots 1 to 4 inclusive were sown on 9th June; plots 5 to 8 on 10th and 21st July; plots 9 to 12 in September; plots 13 and 16 early in October; and plots 17 to 20 on 19th October.

I selected seventeen varieties of phormium in the Miranui and Whitaunui Swamps. As these varieties are not yet thoroughly studied and compared, they have been given tentatively numbers for distinguishing purposes. I also obtained from Mr. Pickett, Whitaunui, a variety of mountain-phormium; from Mr. P. Rikihana, Otaki, two varieties—*aho* and *whenu*; from Mrs. John Field, Paraparaumu, one variety—*tihore*; and from Mrs. W. Simcox, Otaki, seed from a "bronze" variety, and plants from three different varieties, which are not yet compared and identified. As the plants were not seen, examined, and compared when in flower, the identification and description are not complete, and there may be two or three similar varieties.

Most of the varieties were tested for their fibre quantity and quality. A series of six to eight tests for each variety were made, from 12 lb. to 25 lb. being used in each test. Following are the results :—

Variety.	Yield of Unscutched Fibre.	Yield of Finished Fibre.	Grade.	Disease-resistance.
	Per Cent.	Per Cent.	Points.	
1	16·0	12·2	70	Good.
2	16·1	12·2	73	Good.
3	14·8	11·2	69	Good.
4	13·8	10·7	72	Poor.
5	15·2	13·0	69	Medium.
6	17·1	13·6	70	Medium.
7	16·4	13·0	72	Medium.
8	19·0	14·2	69	Good.
9	14·9	12·1	70	Medium.
10	5·2	2·5	Reject	Good.
12	19·8	16·8	68	Good.
13	18·5	14·5	72	Good.
14	17·6	12·5	70	Good.
15	19·8	16·3	70	Good.
16	18·9	15·3	69	Medium.
17	18·0	13·3	69	Good.
Aho	16·2	11·2	70	Medium.
Whenu	20·5	16·8	72	Good.
Tihore	19·4	15·4	78	..
Bronze	22·0	18·8	69	..
Chocolate margin ..	17·8	15·3	71	Medium.
Waikanae	22·4	17·9	68	..

NOTE.—Disease-resistance is not recorded in the case of "*tihore*," "bronze," and "Waikanae," these plants not having been under observation while growing.

A number of plants selected for disease-resistance by Messrs. R. Waters and E. H. Atkinson, of the Biological Laboratory, Wellington, were also received, but are not yet large enough for the various tests. They will be reported on later.

A considerable proportion of the seed sown in the nursery was selected with a view to ascertaining (1) to what extent cross-pollination takes place between the different varieties; (2) whether seedling plants are more vigorous growers than plants grown by vegetative reproduction; (3) whether the seedling plants keep as healthy or healthier than the parent plants. The parent plants are all marked and kept under observation. A few of them are planted in the nursery on the slope of the terrace.

There are also planted two rows of badly diseased plants. The plants in one row were sterilized for half an hour in a corrosive sublimate solution of 1 in 800. In two rows the seed was gathered from diseased plants to ascertain if there is any difference between seed from healthy and from sick parents. An aggregate of about half an acre was sown with seed. The chief reason for sowing so much was that it is easier to find plants with the desired characters in a multitude than among a few.

IMPROVED METHODS OF CUTTING.

Being convinced that the common method of cutting is very bad for the phormium-plant's growth I sought to discover a better

practice. To be able to demonstrate to the millers the best way of cutting for the plant's future growth I selected in the mill block at Miranui four plants of the same variety, size, and amount of fans, and cut them on 28th March, 1922. The first one was cut in the manner favoured by the working cutters; the second in the way the swamp-manager likes to cut (at Miranui the phormium has not been cut so low as at most other mills); the third 4 in. higher than the second and 8 in. higher than the first plant; and in the fourth the side or mature leaves only were cut.

At present, after a year's growth, the difference is so striking that one can see it from a distance. In the first-cut plant three fans have died, and in the remaining fans the leaves are small, spindly, affected by disease, and of a sickly yellowish-green appearance. The second plant has not lost any fans, but the leaves are very small and much affected by different leaf-diseases. The third is much bigger than the two first plants, and is very vigorous and healthy looking. The fourth plant, with the side leaves cut, is the best, although the side leaves were cut again in August, 1922.

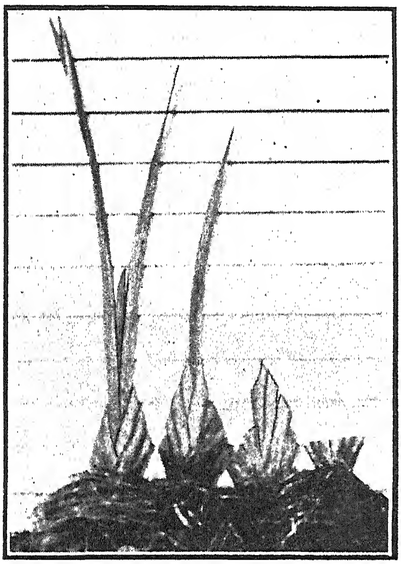


FIG. 2. SHOWING METHODS OF CUTTING PHORMIUM-PLANT.

From left to right—(1) Side leaves cut, with two middle leaves and centre shoot left intact; (2) fan cut diamond-shape, with centre leaf left; (3) cut diamond-shape; (4) common method —whole fan cut level.

[*Photo by H. A. Seifert.*

It may be mentioned here that when I showed Mr. Alfred Seifert these plants, after they had grown for about three months and the difference in the growth could be plainly noticed, he informed me that he had tried (but not followed up) the side-leaf or mature-leaf method of cutting on a quarter of an acre at Piaka, in the Moutoa Swamp, some twenty years ago. Later he showed me a fifty-year-old volume of parliamentary papers in which was given in full the report of the first Commission on the phormium-fibre industry, in 1871. In the report it is recorded that a Mr. Nelson, of Napier, advised cutting the mature or side leaves, but no reason is given for such method.

In order to obtain more evidence against the existing bad method of cutting I counted the dead leaves in four-year-old and five-year-old blocks of phormium, and found by a series of twenty-seven counts that where 100 tons of leaf is cut there is about 120 tons lost in dead leaves. It is easy to understand this if one is aware that the fan produces nearly every month a new leaf (there is an exception of one

FIG. 3. SHOWING (ON LEFT) AREA CUT BY SIDE-LEAF METHOD AND (ON RIGHT) AREA CUT BY COMMON METHOD.

Cutting was carried out on same date (12/10/22) in each case.

FIG. 4. AREA CUT DIAMOND-SHAPE, WITH CENTRE LEAF LEFT INTACT.

Cut 17/1/22; photo taken 25/5/23.

[*Photo by G. W. Haycock.*

to three months in the year, depending on the variety). The life of a leaf is about one year and nine months at the most.

In order to demonstrate on a more practical scale the importance of the method of cutting I measured off in the swamp, where the cutters were cutting for the mill, plots of $\frac{1}{20}$ acre each for diamond-shape cutting and for side-leaf cutting respectively. These plots were cut on the same day as the cutters cut adjoining phormium. The leaves in the plants cut diamond-shape were cut just where they start to separate from the sheath. In the side-leaf cutting the leaves were cut at the same place as in the diamond-shape cutting, except that the two middle leaves and the centre shoot between them were left intact. At date of writing (May) there are on the side-leaf-cut plant four to five full-grown leaves, which have grown since the cut was made in October, 1922. I also, in November, 1922, cut an area diamond-shape with the centre leaf or shoot leaf intact, at the time when the cutters cut the adjoining phormium.

Mr. Alfred Seifert is the first miller in New Zealand to definitely adopt the side-leaf method of cutting. He started to cut in this way (for the Miranui mill) on 4th January this year, has kept two strippers running continuously, and will continue cutting all the year round. Mr. Seifert's opinion is that, taking into account the increased yield obtained by side-leaf cutting, it is commercially advantageous to adopt this method. By side-leaf cutting it is possible to harvest three times more phormium in four years from a given area than by the old whole-sale-chopping method. There are also other advantages of side-leaf cutting which may be dealt with later.

FUTURE WORK AND POTENTIAL RESULTS.

There have been tested at the Miranui mill twenty-two varieties of phormium, among which the fibre-content varied from 2·5 per cent. in No. 10 to 16·8 per cent. in No. 12 in those from Miranui and Whitaunui Swamps, and up to 18·8 per cent. recorded for the "bronze" variety (see preceding table).

Dr. B. D. Cross has identified forty-two varieties of phormium, and the Maoris about sixty, so there are from twenty to forty varieties to be tested yet. There may be varieties which greatly exceed even the above-mentioned 18·8 per cent. Numbers 1, 2, 12, 13, 14, and 15 seem to resist the yellow-leaf disease, but there may exist absolutely disease-resistant varieties. The next most important step in the investigation is therefore to obtain as far as possible plants of all the existing varieties in New Zealand, also in Norfolk Island.

In order to make the breeding and selection branch of the investigation self-supporting it will be necessary to plant from 10 to 20 acres of phormium—one-half of that area to seedling plants and the other to selected plants from the swamp. The land has to be well prepared before planting, and after planting cultivated as long as the growth of the plant permits. This work will have to be done on proper farming lines on a strictly commercial basis to ascertain the profitableness of phormium when grown as other farm crops. Once it is practically demonstrated that good profit can be derived from phormium-growing people will start to cultivate it, and there will be a demand

for good plants. The growing and selling of plants should thus defray the cost of this part of the work.

Luther Burbank says that no one can estimate the great possibilities of a wild plant before it is taken into cultivation. Our *Phormium tenax* is claimed to yield more fibre from a given area than any other known fibre-plant. So far these investigations show that there are great possibilities if the plant is cultivated like other farm crops. The estimates are based on its wild state in the swamp and give striking indications. Assuming that a certain area yields 100 tons of fibre every four years under the present ordinary cutting method and the present average state of phormium swamps, I estimate that similar areas under improved conditions are capable of yielding as follows :—

Condition of Area.	Yield by Present Method of Cutting.	Yield by Side-leaf Cutting.
	Tons.	Tons.
Average phormium area	100	300
Area freed of weeds	120	360
Area planted wholly in best varieties and kept clean of weeds	180	540

The highest average yield of phormium-leaf from 1,000 acres in the Makerua Swamp was 28 tons per acre in four years, or 7,000 tons per annum. It takes slightly over 8 tons of leaf to produce 1 ton of fibre, consequently the fibre-production of 1,000 acres under the old methods would be 870 tons yearly. By cleaning the weed-growth out of the swamp the fibre percentage of the phormium would be increased to the extent that the yield of this same area would be 1,064 tons of fibre. By planting the same area in the best selected varieties only the yield would be 1,219 tons. But by employing the side-leaf cutting method the yield in each case would be trebled. Then 1,000 acres in the present state would give 2,610 tons of fibre ; if cleaned of weed-growth 3,192 tons ; and if the best varieties only were planted on that area the production would reach the remarkable total of 3,657 tons of fibre per year. By selecting and growing the present best varieties on a 1,000-acre area, and keeping the plants clean of weeds, when the phormium was fully developed it would yield, by cutting side leaves every year, in ten years, according to the foregoing estimate, $3,657 \times 10 = 36,570$ tons of fibre. A similar area of the present average phormium cut by the old method would not yield as much in forty years. While, of course, there is an element of theory in these calculations, there is strong evidence that such yields may be readily attained in practice.

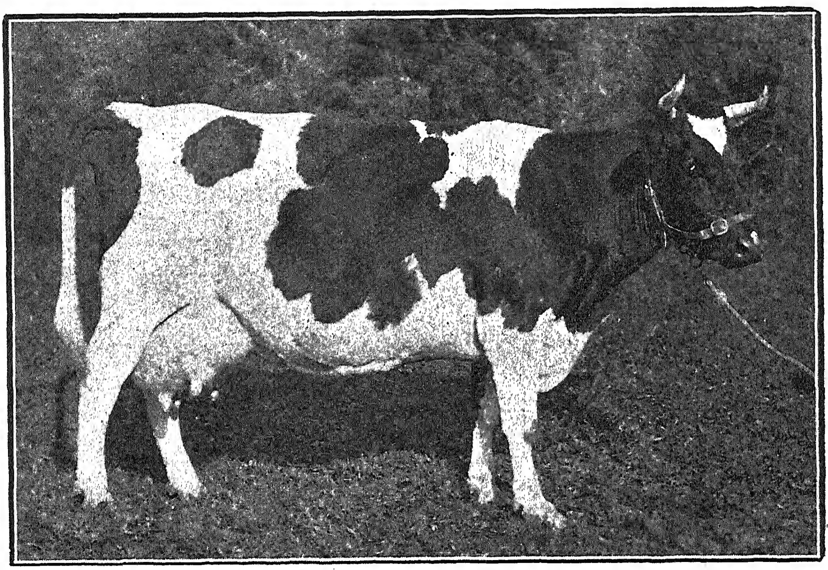
CONCLUSION.

In concluding this account I have to express my thanks to all those who have so kindly given plants and seed for experimental purposes ; also to Messrs. M. Campbell, Carkeek, Greedy, and H. A. Seifert, of the Miranui mill, and especially to Mr. Alfred Seifert, for their kind help and co-operation in the work of investigation. If the phormium-fibre industry is put on a really profitable basis it will be greatly due to Mr. A. Seifert's efforts to ascertain the commercial possibilities of the side-leaf-cutting method, this being a matter of prime importance.

TESTING OF PUREBRED DAIRY COWS.

HILDA MINTO DE KOL'S 1,000 LB. CERTIFICATE-OF-RECORD.

THE Friesian cow Hilda Minto de Kol, owned by Mr. C. H. Steadman, of Kamo, Whangarei, qualified for certificate by calving on 2nd June, subsequent to her year on C.O.R. test. Commencing her lactation period and test on 23rd March, 1922, she milked the full year—giving, in fact, for the 365th day no less than 46·5 lb. of milk. Her total production was 27,773·8 lb. of milk, containing 1,046·31 lb. of butterfat, which represents an average test of 3·76 per cent. Her highest production of butterfat for a full calendar month was 110·03 lb., and her lowest 63·06 lb. This is a remarkable achievement, and its significance is considerably enhanced when it is recognized that Hilda Minto de Kol commenced her test at the age of 12 years 56 days.



HILDA MINTO DE KOL.

Hilda Minto de Kol has been granted certificates-of-record on two previous performances. She was first placed on test in 1918, at the age of 8 years 179 days, when she yielded 12,644·8 lb. milk and 402·78 lb. butterfat. Two seasons later she gave 738·07 lb. butterfat from 22,922 lb. milk. She has now increased this creditable performance by no less than 308·24 lb. of butterfat, bringing her record to the 1,046·31 lb. stated above. Thus in three alternate seasons under test she has returned her owner an aggregate of 2,187·16 lb. butterfat, or an average of 729·05 lb. in 346 days.

Hilda Minto de Kol was imported from Canada in 1913, and her ancestors figure in the pedigrees of several high-producing Canadian Friesians. The accompanying photograph shows her to be a good stamp of Friesian of the more robust type, her roomy body, well-sprung rib, and general appearance indicating her as an animal which with good handling might be expected to give a good account of herself. Mr. Steadman is to be congratulated on his ownership and management of an outstanding cow.

—*W. M. Singleton, Director of the Dairy Division.*

MANURES AND MANURING FOR GARDEN CROPS.

W. H. TAYLOR, Horticulturist, Wellington.

THE purpose in this article is to refer in a brief manner to the fertilizers and manures most commonly used, and to give some indication of the requirements of ordinary garden crops. It is understood that a number of elements are required by plants in addition to those usually applied in manuring. These are found in most soils in sufficient quantities, or are supplied from the atmosphere. Deep tillage and draining, where necessary, by warming the soil and admitting air assist nature in making available the natural constituents of soil and of the atmosphere. Most cultivated soils throughout the world are deficient in phosphoric acid, potash, nitrogen, and in some cases lime. All plants take out varying amounts of these elements, and manuring is designed to maintain the supply. New Zealand soils are generally very deficient in phosphoric acid; it is for this reason that phosphatic fertilizers are of such great importance in this country, and that they must be liberally employed.

The practice of crop rotation is based on the fact that crops that are unlike each other take up different amounts of the various elements. By rotating the crops a fuller use is made of the fertilizers, one crop taking what another has left. There also appears to be some other influence at work, as it is generally admitted that crops do not give the best results if grown repeatedly in the same soil, even though the proper fertilizers be applied for each crop. A notable exception is onions; these succeed for an indefinite number of years in the same soil. Probably this is because onions require a fairly well-balanced fertilizer, and take most of it out of the soil. An extra amount of nitrogen should be applied to crops that are required to make strong vegetative growth and are not grown for their fruit, such as the cabbage tribe, onions, leeks, spinach, and celery.

Theoretically at least large amounts of nitrogen would be wrong for tomatoes, which are naturally inclined to be gross in growth, and which are grown for the fruit. It is well known that plants making soft growth are those most liable to attack by fungus diseases, tomatoes and potatoes being noteworthy examples. Yet blood manure, which is almost solely nitrogenous, is the fertilizer most commonly used

by tomato-growers. In some cases blood-and-bone is used ; this should be much safer, as bone is a phosphate, though it does contain a modicum of nitrogen, and the blood-content is considered to be in a milder form than in pure blood.

The position as it appears to the writer is as follows : Blood manure is used because it is thought to be a quick-acting fertilizer that will push young plants into rapid growth and bring the crops along early. This is a mistake : blood has to undergo a change in the soil before it is available, and it is comparatively slow in action. The opinion is expressed that if it were quickly available it would induce a soft growth that might result in harm, because during the early part of the season there is usually a fair amount of rain. Every one knows that blight is most prevalent after a spell of wet weather ; the weather is blamed, but the part the fertilizer may have had in the trouble is not considered. The fact seems to be that during the early part of the season the blood is not available, not having undergone the necessary change. After that time there is seldom a great amount of rain, and as a fertilizer can be taken up only in solution and in a dissolved state the plants get only a moderate amount of it. If, however, a period of wet weather occurs the plants will get all they can absorb of the blood, which will then be in an available condition. The case may be summed up in this way : If the fertilizer were available a little at a time and all the time it might do no harm. When a dry season is experienced it does no harm, because most of the blood remains in the soil. If the season is a wet one, or if a spell of wet weather occurs, the blood is taken up and damage is caused. Similar results follow the use of fresh stable manure, but the effect is felt early in the season, as its elements are more readily available. It appears logical that the bulk of the fertilizer for tomatoes should be of a phosphatic description, particularly as phosphates tend to promote early maturity, and the lateness of the open-air crop is its chief drawback.

The practice of manuring for garden crops is different from that of the farm. In the latter case all that usually is wanted is sufficient fertilizer to give the young plants a start, as the period of cropping the land is comparatively short, and fertility is maintained by means other than the application of fertilizers. On the other hand, garden-soil is subject to continuous and intensive cropping, and the crops are mainly dependent on the fertilizers applied, consequently much larger quantities must be used, and they must be of a fairly complete character. Amounts much beyond the requirements of the current crop should not, however, be used. The effect of an overdose would in some cases be immediately harmful, while in others the effect, though in the direction sought, might be altogether too pronounced. For example, nitrate of soda has so powerful an influence on growth that quite small amounts produce the effect desired, while large amounts would set up such strong growth as to seriously delay maturity, prevent such plants as lettuces from hearting, and render a plant, by reason of its soft texture, particularly liable to disease. Authorities state that an oversupply of potash can stop growth altogether. The case of stable or farmyard manures is different. These are largely composed of organic matter, which rarely can do harm, while the fertilizing properties are of a different character from those in artificials.

PHOSPHATE.

Phosphoric acid promotes root-formation, causing young plants to root freely, and lays the foundation of a thrifty plant. It builds the framework of a plant, promotes fruiting, and hastens maturity while also increasing the nutritive value of the crops. It is supplied by the following phosphatic fertilizers:—

Superphosphate.—On most soils superphosphate is the most effective phosphatic fertilizer when equal amounts of phosphoric acid are compared, but for the full benefit to be received from this fertilizer the soil should contain an abundance of lime. Where sufficient lime is not present the free phosphoric acid combines with iron or alumina, forming more or less insoluble phosphates, and therefore much of the phosphoric acid is lost to the plants it is proposed to benefit. The soils in which applications of superphosphate do not have full beneficial effect are light sands and gravelly soils deficient in lime, peaty soils containing sour humus, and sour soils generally. The effectiveness of this form of phosphatic fertilizer seems to be due to the fact that owing to its solubility when put in the soil, even though it reverts quickly, it is deposited in a very fine state of division throughout the soil in the neighbourhood of the roots of plants. It has a wonderful effect in promoting rapid root-development, and thus is specially valuable to shallow-rooted plants and to short-lived crops that have to develop rapidly. In order to secure a more lasting effect for crops that have a long season of growth it is customary to use a phosphatic mixture of superphosphate and bonedust, two of the former to one of bonedust.

Basic Superphosphate.—This is ordinary superphosphate with which has been mixed caustic lime in the proportion of about 15 lb. to 85 lb. of superphosphate. Therefore 100 lb. of basic superphosphate has only the same amount of phosphoric acid as is contained in 85 lb. of ordinary superphosphate. It would consequently be cheaper to apply lime to the soil in autumn and use ordinary superphosphate in spring. Basic superphosphate is useful where liming has been neglected.

Basic Slag.—The phosphoric acid in basic slag is not nearly so soluble as that in superphosphate, and slag is on that account not so serviceable in dry soil. It is particularly useful for heavy clay soils where there is a good rainfall or where irrigation water is used. It contains a high percentage of free lime in addition to that combined with the phosphoric acid, and is therefore useful where lime is deficient. It requires from 1¼ to 1½ cwt. of basic slag to supply the same amount of phosphoric acid as 1 cwt. of superphosphate.

Bonedust.—This consists of the bones of animals, and as the calcium phosphate in the bones is in an insoluble form, the fertilizer must be finely ground if the plants are to get much of the phosphoric acid in the year it is applied. Failing this fine state of subdivision the phosphate is but slowly available. It is usually safe to assume that the phosphate is not all used up the season it is applied, especially if the season is dry. Finely-ground steamed bones are good for use on light soils poor in lime, such as sands and gravel. Mixed with superphosphate it forms a lasting fertilizer, the superphosphate coming into use first.

Nauru Rock Phosphate.—This is the cheapest form of phosphoric acid, but fineness of grinding is essential for its efficiency.

NITROGEN.

Nitrate of Soda.—This salt is readily soluble in water, and is in a state that renders it immediately available to plants. It is of great value as a spur to lagging growth, and as an aid to the growth of most crops, especially those that require to make a large amount of green growth, such as the cabbage tribe, lettuces, onions, leeks, spinach, and asparagus. The effect of nitrate of soda is so pronounced that only quite moderate applications are necessary or safe. The effect of a proper amount is to promote a healthy state of growth. An overdose causes a rank and flabby growth. So potent a fertilizer is capable of doing a great amount of good, but it must in most cases be used in moderation. Being so readily soluble it should be applied only to growing crops, otherwise it is liable to be washed out of the soil before it can be used by the plants. Half an ounce per square yard, equal to 1½ cwt. per acre, is a fair dressing for onions. Two applications should be made, one when thinning is completed, the other about a month later. There is no reason why this amount should not be doubled; it may be necessary in cases where growth is very poor.

Sulphate of Ammonia is another important nitrogenous fertilizer, differing from nitrate of soda in that it is more slowly available. This property renders it able to fill a part for which nitrate of soda is not adapted; all crops require some nitrogen, but not all are benefited by the pronounced effects of nitrate of soda. Again, plants that have special nitrogen-requirements need it all the time, and this requirement is supplied by sulphate of ammonia. The correct way to use it is to apply it in late winter or spring when other fertilizers are applied. Some amount of it is soon available, but a whole season is required for it to be all taken from the soil. In this way it has a double use; it is of itself sufficient for those plants whose nitrogen-requirements are low; and it gives a constant supply to plants that have a special nitrogen-requirement, any extra demand being very appropriately supplied by special applications of nitrate of soda.

Dried Blood.—Blood is essentially a nitrogenous fertilizer; it contains some amounts of other elements, but these are so small as not to be worth considering. It is not at first available as plant-food, but most of it can be taken up during the season it is applied. There is an amount of salt in blood sufficient to cause harm if used in excess.

Blood-and-bone.—Blood is more frequently used when combined with bone than separately. This combination forms a lasting nitrogenous and phosphatic fertilizer, useful as a change manure for all crops that require a considerable amount of nitrogen.

POTASH.

Potash forms starch and sugars, thus stiffening the tissues and making plants better able to withstand disease. It directly affects the fruit of plants, making them firmer. Potash has proved to be very beneficial to tomatoes, saving them from the destructive disease known as black-stripe, and improving the quality of the fruit. Pulse

crops, such as peas and beans, are benefited by potash, and the period of bearing extended; root crops, such as potatoes, sweet potatoes, and artichokes, are improved in texture. Potash bears the same relation to the fruiting properties of crops as nitrate of soda does to the vegetative growth of plants. Potash is fairly abundant in most New Zealand soils, especially those of a clayey nature, but it is not always in a readily available state, and it is good practice, at least in the case of short-lived crops, to add a small amount in an available form.

Sulphate of Potash.—This, the most generally useful form of potash, is a purified potash salt. It grades usually 90 or 95 per cent., which is nearly four times as rich in potash as kainit.

Kainit contains sulphate of potash mixed with a good deal of common salt (chloride of sodium), Epsom salts (sulphate of magnesia), and chloride of magnesia. It will be evident that to get the same equivalent of potash as from sulphate of potash about four times the weight would have to be used. Kainit is often used for asparagus, for which the salt-content is useful. For other crops it should be applied during winter several weeks before sowing or planting, so that the salt may be washed out by rain. Potash is not readily leached from the soil, so that sufficient for the season can be applied in spring.

Muriate of Potash is the potash equivalent of common salt. It is highly irritating and injurious in contact with plant-roots. The way to apply it is as a top-dressing soon after the plants have started, taking care to keep it from actual contact with the plants. It should be scratched lightly into the soil.

Wood-ashes contain varying but always useful amounts of potash, which, being in the form of a carbonate, is immediately available to plants. The ashes should be protected from rain until they are applied to the soil, as the potash is highly soluble and is quickly washed out. Once in the soil, however, it is held till plants take it up, or, at any rate, it is only very slowly leached out. About 7 lb. per square rod is a fair dressing.

LIME.

Besides being a plant-food lime helps most soils by improving their physical condition—the structure of the grains. Clayey soil is made more open, and sandy soil closer. Lime sweetens the soil—corrects acidity—thereby aiding the little organisms called bacteria. It liberates potash already in the soil, and its relation to potash is such that authorities state that it is useless to apply potash to soil deficient in lime. The disease of crucifers (cabbage, &c.) known as club-root has never been known to occur in the first place where a sufficiency of lime was present, the disease being promoted by an acid state of soil.

Lime is obtainable in two forms—burnt lime and ground limestone, known as carbonate lime. Burnt lime is also known as roche-lime and quicklime. It comes from the kiln in lumps, which break down to a very fine powder when water is taken up. Quicklime on exposure to air gradually takes up moisture from the atmosphere and breaks up; it is then known as air-slaked lime. It is in this form that it is useful for killing slugs and other garden pests. The caustic properties of quicklime cause it to burn up humus in the soil, therefore it should not be used on land poor in humus. It is the best form for

use on swamp lands and other soils where a good deal of humus is present, also for clay soils. Air-slaked lime is, all things considered, the best form of lime for garden purposes, where success will certainly not be met with unless a good supply of humus is maintained. Moderate dressings of, say, half a ton per acre annually will on ordinary soil be better than heavier dressings at longer intervals, except in places where there is a special need for lime, where amounts up to 2 tons per acre may at first be necessary, or more in the case of swamp land and soils quite without lime.

ORGANIC MANURES.

Stable Manure.—All authorities agree that stable manure is the most valuable material of all for garden-work. This is chiefly because of the form of the humus, though it is fairly complete in plant-food; its weakness is in phosphates. Excellent crops have been produced continuously from the same ground with no other fertilizing than that obtained from stable manure and lime. For crops that require an extra amount of nitrogen or potash it will pay to use nitrate of soda or a form of potash, whichever may be required, as a supplement. Stable manure should not be directly applied for root crops, such as carrots, parsnips, and beet. These do well on land well manured the previous year for another crop, and with no addition of fertilizers. Moderate quantities of stable manure may be used for potatoes, but heavy dressings should be avoided, being liable to cause a great growth of haulm at the expense of the roots.

Farmyard Manure is in some cases quite different from stable manure, as it may contain cow-manure as well as horse-droppings. Such material should be well rotted before it is used; if not, much of it may be a long time decomposing, and that is bad. From 20 to 30 tons per acre is a good dressing of these manures.

Cow-manure is less rich in plant-foods than is stable manure. It is valuable for light and sandy soils, but its use on heavy or medium heavy soil should be avoided. It makes such soils unworkable.

Pig-manure is in manurial value intermediate between stable and cow manure. In other respects it is similar to cow-manure, being wet and heavy.

Sheep-manure is richer in plant-foods than stable manure, decomposes readily, and does not impair the working-quality of the soil. It has the objection of being full of grass and weed seeds, and if stored till these have germinated a large proportion of its fertilizing properties are apt to be lost. However, it still remains a valuable material.

Poultry-manure, when properly preserved, is worth in fertilizing properties eight times its weight of stable manure. The best way to preserve it is to collect the droppings frequently and mix them with dry soil, keeping the heap under cover and turning it over occasionally. The dry soil will hold the ammonia, the most valuable constituent. Lime or wood-ashes must not be brought in contact with the droppings, as either will drive off the ammonia.

In reply to a correspondent the Department's Chemist gave the following information: "The value of fowl-manure is very much

enhanced by the addition of about half its weight of superphosphate. This should be mixed with the manure as it is collected from the roosts from time to time. This prevents the volatilization of any ammonia which would otherwise be liberated continuously from the manure. To improve the mechanical state of the final product it is advisable to intimately mix it with about one-third its weight of sawdust or peat. Such a mixture when sold as a garden manure should command a good price, and give good results where used with discrimination by vegetable-growers. For field-crops and fruit it should be used with extreme moderation, as, owing to the high availability of the nitrogen, it may unduly stimulate growth and produce a rank, weak plant which will be subject to attacks of disease organisms."

HUMUS.

Humus is an absolute necessity. Where even a moderate supply of stable or farmyard manure is available its judicious use will be sufficient for the purpose. Considerable quantiiies of waste vegetable matter in gardens can also be used. This, however, will not be sufficient, and, failing stable or farmyard manure, green crops must be grown for turning in. Nor are fertilizers alone sufficient; soil may be well supplied with these, yet in the absence of humus may be comparatively sterile.

SOIL-REQUIREMENTS.

It is a comparatively easy matter to state the chief requirements of various plants: it is a quite different thing to say what should be applied to any particular soil to obtain the desired result. Soils vary so greatly that it is impossible to lay down a rule that will apply to all alike. Nor does analysis of the soil help much, for this has been found to be very misleading. There are forces at work in the soil which analysis does not reveal, and, though it shows what is in the soil, analysis does not in all cases indicate whether or not the various elements are in a form available to the roots of plants. Scientists throughout the world now agree that soil-analysis by itself is of comparatively little use; experimental work must be done in each case before the best results can be secured. A knowledge of the chief requirements of plants and the effect of the various fertilizers is useful and important, because it teaches the direction in which we should move, what to avoid, and what to use. Within these limits the cultivator must judge by results as to what additions or omissions are required.

AMOUNTS OF FERTILIZERS TO USE.

Assuming that fertilizers are being used without organic manure a maximum and minimum may be stated with fair certainty as follows, the quantities being per acre: Superphosphate, maximum about 10 cwt., minimum 3 cwt.; bonedust (not all available the first year), maximum 12 cwt., minimum 4 cwt.; blood-and-bone, maximum 12 cwt., minimum 4 cwt.; sulphate or muriate of potash, maximum 2 cwt., minimum 1 cwt.; nitrate of soda (to be applied only to growing plants and in one or more applications according to judgment), 1½ cwt. to 2 cwt.; sulphate of ammonia, 3 cwt. (equal to 1 oz. per square yard). This latter form of nitrogen is suitable for use for crops that are stated to require a minimum amount of nitrogen.

The use of nitrate of soda to supplement this for plants that have a larger nitrogen-requirement has been previously referred to.

In cases where a partial supply of animal-manure is used, this should be supplemented by suitable fertilizers, using minimum amounts.

Crop-requirements may be stated as follows :—

Requiring principally phosphates, with a liberal supply of potash and a small supply of nitrogen : Turnips, carrots, beetroot, parsnips, radishes.

Principally potash, with a moderate supply of phosphate and a small amount of nitrogen : Potatoes, onions, leeks, artichokes, shallots. (This is not to be taken to mean that the potash should be largely increased in amount or be greater in amount than the phosphate. It means that the maximum of potash should be used and an amount of phosphate lower than the maximum stated.)

Principally nitrogen, with a liberal supply of phosphate and a small amount of potash : Cabbages, spinach, celery, asparagus, cauliflowers, rhubarb.

Phosphates and potash, with a small amount of nitrogen : Peas, beans, melons, marrows, pumpkins, cucumbers, tomatoes.

It seems necessary to add that onions and leeks are rightly placed with those plants that have special potash requirements, but they are benefited by a greater amount of nitrogen than are the other plants they are bracketed with, responding well to nitrate of soda, as stated earlier. Peas are usually regarded as having no need for applied nitrogen, but these are exceptional cases in which they do require it. Where they are lagging in growth for no apparent reason a dressing of nitrate of soda should be tried.

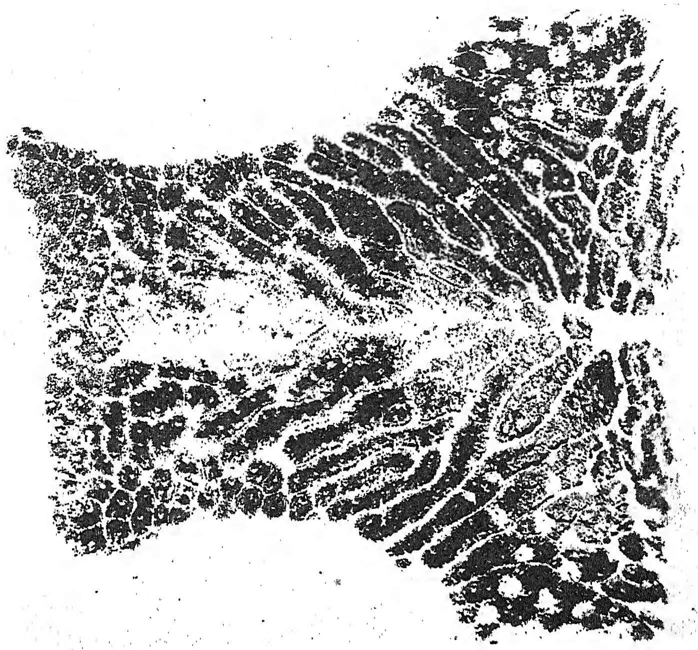
REGISTRATIONS OF FACTORIES, ETC., UNDER THE DAIRY INDUSTRY ACT: 30th April, 1923.

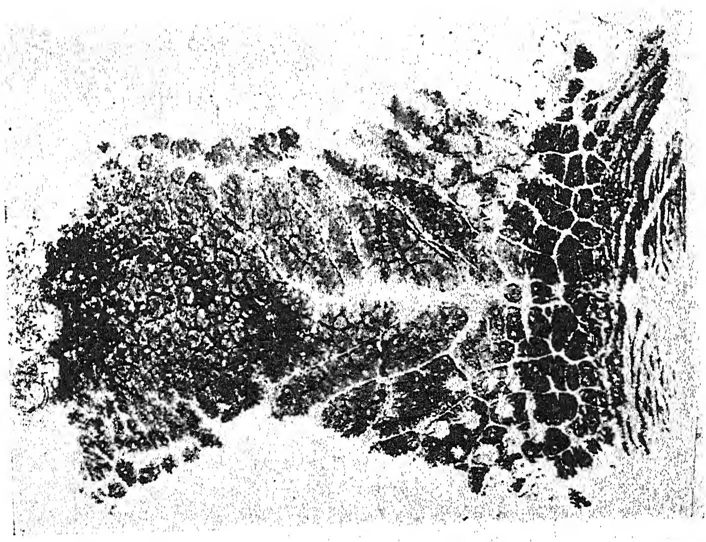
District.	Creameries (Butter).	Factories (Cheese).	Dual Plant (Butter and Cheese).	Private Dairies.		Packing-houses (Milled Butter).	Totals.
				Butter.	Cheese.		
Auckland ..	71	52	6	..	..	2	131
Taranaki ..	20	89	23	2	..	..	134
Wellington ..	17	60	7	..	..	7	91
Hawke's Bay ..	11	17	4	..	..	..	32
Nelson	6	4	1	..	..	7	18
Marlborough ..	4	6	1	..	..	..	11
Westland ..	7	3	..	..	..	..	10
Canterbury ..	12	15	2	..	3	..	32
Otago and Southland	17	80	..	..	..	..	97
Totals ..	165	326	44	2	3	16	556

Seven milk-powder factories (four whole-milk and three skim-milk plants), one condensed-milk factory, and three casein-drying factories are also established in the Dominion.

COW NOSE-PRINTS TAKEN AT THE WALLACEVILLE LABORATORY FARM.

The lately devised method of cattle nose-prints is being adopted for identification purposes in much the same way as the human finger-print system. The specimens here reproduced well indicate the practically limitless variations of which the surface of the bovine snout is capable.





SEASONAL NOTES.

THE FARM.

DRAINAGE.

As a rule, very little in the way of cultivation is practicable in July, and the month offers a good opportunity to finish any drainage-work that was commenced in the autumn. In many districts there are large areas of flat clay land that would be greatly benefited by tile draining. Drained land is not so badly poached or puddled by the tramping of stock in the winter-time, and in consequence it does not become so dry or liable to crack in summer. Drained land is earlier in the spring than undrained land and allows more latitude in time of cultivation. Draining of clay land is best done in the winter, as the soil can then be more easily worked and there is plenty of water in the drains to enable the drainer to judge the fall.

PASTURE-MANAGEMENT.

Where not already carried out, top-dressing should be pushed along. Suitable manures for this time of year are basic slag, basic super, and super and Nauru phosphate (half-and-half). In the earlier districts superphosphate alone will give good results; where lime has been applied earlier the super is best applied from the middle to the end of July. The harrows should be kept going to scatter stock-droppings. Now also is a good time to give a final harrowing to a top-dressed paddock and close it up for early calving cows or early-lambing ewes. There is no better tonic for a newly calved cow or lambed ewe than a piece of nice clean pasture. Pastures intended for haying next season will also greatly benefit from top-dressing and harrowing.

FEEDING OF FORAGE CROPS.

The feeding of roots will now be general, and where several kinds, such as swedes, carrots, and mangolds, are grown, the swedes are best used up for the dry cows, reserving the carrots for the cows as they come into profit, and the mangolds for August and September feeding. It may be well to repeat that mangolds should not be fed to dairy cows until they have been out of the ground for some weeks. In feeding out mangolds to cows it is advisable to see that the small roots are cut up. Cows are apt to swallow a small mangold whole and get choked in consequence. The roots can be most easily cut after they have been carted out to the field and scattered over the ground.

Cows feeding off swedes should be allowed a good ration of hay, or a run-off on to a field with rough feed. Allowing cows to gorge themselves on frosted turnips is a continual source of trouble; they should be kept off the field till well on in the day, and given a good feed of hay before being turned in.

In some districts Thousand-headed kale and similar crops are provided for August and September feeding. Great care should be taken to see that the ration is not too liberal, otherwise redwater and other stomach troubles may result. If this class of forage is cut and allowed to wilt for a day such danger is greatly reduced.

Dairy cows and springing heifers should have special attention from now on till calving-time. If feed is limited it is better to give it to the animals now rather than let them go back in condition with the idea of reserving the feed till they come into profit. If the dairy cow is to be pinched at all for feed she will stand it much better in the spring, when she has got rid of her calf, than in the winter when she is carrying it and has to find nourishment both for the calf and herself.

Early-sown fields of oats or wheat that are showing much growth should be fed down if the land is dry enough. This should be followed with a stroke or two of the tine harrows to open up the land.

PLOUGHING IN GREEN CROPS.

Where cover-crops are grown for green-manuring, care should be taken that the stuff is turned under sufficiently early to allow it to rot before the following crop is sown. Usually from four to six weeks will be sufficient, and, of course, the heavier the cover-crop the longer it will take to decay. If it is found that the crop cannot be turned under sufficiently early to allow the material to decay, it will be better to feed off the crop and turn under the manure from the stock.

THE NEXT DAIRYING SEASON.

In several dairying districts cows will be coming into profit towards the end of July, and all preparations for a busy season should be pushed along, especially repairs to milking-sheds and yards. The longer new concrete-work stands before being used the better. Where a milking plant is installed it should be well overhauled, and the engine put in good repair.

—*Fields Division.*

THE ORCHARD.

PRUNING.

APPLE-TREES on seedling stocks growing on rich heavy land in the orchards of the north-western States of America may require very little pruning after reaching maturity, but the dwarf tree on the prolific Northern Spy stock as we grow it in this Dominion requires more attention from the fruitgrower in this respect. The heavy-bearing properties and high-quality fruit from this type of tree can usually be maintained only by seasonable cultivation, manuring, and suitable annual pruning.

It is the custom now to grow the fruit on the laterals as well as on the spurs with which the framework of the tree is furnished. This furnishing in the best types covers the base as well as the upper parts of the tree; indeed, the base is a little more closely furnished and carries heavier laterals than the upper leaders. The base, being mechanically strong, is required to carry as much of the crop as possible; the heavier laterals there do no harm, as they shade only the ground. The pruner is recommended to keep this type in mind when carrying out his work, and gradually to modify the condition of that common class of tree which has bare forks at the base, brought about chiefly by the overfurnishing of the upper leaders with heavy laterals. The latter are not only detrimental in that they cast a heavy shade, but when loaded with fruit their top-heavy condition becomes a difficult problem.

Pruning is one of the main factors in the success of our orchards, and success can be secured only by giving careful consideration to the different varieties and sometimes to individual trees. How common are overfurnished Delicious and Cox's Orange trees; and, instead of the laterals being thinned, how often are they shortened to wood-buds, the congestion so accentuated resulting in little or no crop. Sturmers and Jonathans are naturally heavy-bearing varieties that soon lose their laterals unless they are invigorated and renewed by proper pruning. These can usually be pruned to wood-buds with advantage. But in all varieties overfurnishing the framework must be avoided, especially about the tops of the trees.

In the pear-tree we have rather a different problem: the seedling stock and vigorous habit have to be reckoned with. Commonly pear-trees are overpruned, and develop crowded leaders and laterals. Why prune the laterals of such a vigorous subject to wood-buds? Thin them out by all means, but shortening them makes a great amount of work at pruning-time and a very light harvest. By bringing a pear-tree into bearing early the growth is steadied, and a mature tree properly constituted should require comparatively little annual pruning.

GENERAL.

Remember to collect scions for grafting in spring if they should be required.

Fresh plantings should be pushed along when the ground is dry enough. See that trees are planted sufficiently deep and very firm. Many kinds of stone-

fruit may well be planted on good alluvial land where there is a local demand, also lemons where the soil is deep and well drained and the climate suitable. Such land is also suitable for walnuts. Sweet chestnuts of a good variety are becoming popular, and are suitably placed on hilly country. Filberts are also worth more consideration, and some plantations are returning very good crops. Good shelter-belts are beneficial in most localities, and in many they are indispensable.

Should the season be wet see that the water does not lie about the orchard; if it does so a good plough-furrow in the right place will often lead it off. On wet days overhaul motors, implements, and harness; a proper application of oil and paint will save depreciation and give smooth continuous working in the busy season.

The demand for fruit may now be expected to increase. Market the fruit from store in the right order of varieties, and pack to recognized standards. Waste fruit should not be allowed to lie around in buckets or other receptacles, but should be cleaned up daily and fed to stock or buried underground, and not tipped out to rot on adjacent land, as is so often done.

—*W. C. Hyde, Orchard Instructor, Nelson.*

CITRUS FRUITS.

Delayed red-oil spray at 1–40 may yet be applied if found necessary, care being taken not to make the application in any area in which early frosts have affected the trees in the slightest degree, thus weakening their vitality for the time being.

FIREBLIGHT.

The attention of orchardists and others who have common white blossoming hawthorn (*Crataegus oxycantha*) growing on their properties is directed to clauses 2 and 3 of the Fireblight Act, 1922, as follows: "In the case of those districts and parts of districts included in the Second Schedule, all hawthorn shall, between the 1st day of June, 1923, and the 31st day of July, 1923, be cut down so as to prevent any part thereof from flowering, and thereafter shall be similarly cut down in the month of June or July in each year and at such other times as may be necessary to prevent any part thereof from flowering. In the case of the district and parts of districts included in the Third Schedule, wherein fireblight is known to exist, all hawthorn growing therein shall be completely destroyed before the 30th day of June, 1923, and any plants which may appear subsequently shall forthwith be completely destroyed."

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

MATING THE BREEDING-BIRDS.

THE busiest season of the year and the most important one—that for hatching and rearing young stock—is now near at hand. This implies the necessity of getting the breeding-birds mated up at the earliest possible moment; it is a mistake to delay putting the birds together until just before eggs are required for hatching purposes. Every opportunity should be given them to become well settled down and in a proper breeding-condition before the work of incubation commences. This will not only ensure a greater proportion of fertile eggs, but in addition will tend greatly towards their containing stronger germs. When pens are first mated up it frequently happens that the male bird will exhaust himself, and it may be weeks before he regains a condition to produce even a fair percentage of fertile eggs. This does not apply to the same extent where all the hens are not in a laying-condition.

Wise poultrymen, and those who have acted in accordance with advice given previously in the *Journal*, will have selected and specially marked the best breeding specimens during the late autumn, or at some time before the birds moulted. It is at that period of the year that certain signs manifest themselves in a striking manner whereby the good layer can be distinguished from the poor one.

Where the choosing of the breeding females has been left till the flock has moulted, the accurate selection of the most desirable hens will be found a matter of great difficulty. Indeed, in most cases it will be found an impossible task. It is well known that when birds have been hatched at about the same time and have been fed and managed in a similar manner the late moulter is generally the one that has laid the best in the past and is likely to do so again in the following year. Obviously, when a flock has moulted and all birds are in a similar condition so far as their plumage is concerned it is impossible to distinguish between the early and late moulter, except, of course, where they have been specially marked to indicate this point. The poultry-keeper who has neglected to select his late moulters during the autumn may expect a high percentage of unprofitable stock as a consequence.

While lateness of moulting can generally be accepted as indicating good producing-power, this does not mean that all late moulters are suitable specimens for the breeding-pen. Something more is required. If a heavy-producing strain is to be built up or maintained it is imperative for the poultry-keeper to have pictured in his mind a definite type, and to aim for this at all times. Breeding from birds of mixed types merely because they happen to possess good laying-points, or even an ancestral high egg-yielding performance, will never tend towards reaching the desired end. Permanent results can only be secured by breeding from fixed types of purebred strains. Sometimes birds of inferior type will prove good layers, but in a general way such stock have not the power to transmit their laying-qualities to their progeny, and are thus undesirable for the breeding-pen.

In making the final selection, even where the late moulters are concerned, every bird should be carefully examined in order to ensure that it is healthy and possesses undoubted constitutional vigour. No matter what other good points the bird possesses, whether it be male or female, if there is the slightest constitutional taint it should be rejected from the breeding-pen. Health and vigour form the base of all successful breeding operations. Points indicative of these essential requirements are a clean face free from wrinkles and feathers; clear, bright, prominent eyes; short shanks, set wide apart; alert carriage; and tight, glossy plumage; while in the male bird of such breeds as Leghorns, Minorcas, &c., no bird should be bred from where the comb has insufficient base to enable it to stand erect. A folding-over comb usually indicates impaired vigour. The ideal breeding male should have a masculine appearance in every respect, but this does not imply coarseness.

The question of size is another important matter. All birds conspicuously under or over the weight clauses specified in the New Zealand Utility-poultry Standards should be rejected. It is, however, better to have a good big bird than a good small one. No matter how well they have laid, small diminutive specimens of their breed should not be used for breeding. Such stock usually produce weedy progeny which yield only second-grade eggs. In mating fowls the aim should be not only to breed from those birds which lay the most eggs, but also from those producing eggs of good marketable size—that is, of at least 2 oz. The production of small eggs is probably the greatest weakness in connection with present-day poultry-keeping. The size of the egg can be increased only by careful breeding, and by the selection for breeding of only those birds that lay large eggs.

Many specialist breeders secure the individual egg-records of their birds by means of single pens or trap nests. This is too troublesome for the average poultry-keeper to be bothered with, but with a little study and observation, and the annual selection of the late moulters and those birds with a broad back, well-developed crop, and deep abdomen, the egg-yield will be increased to a surprising degree. Never breed from a bird of either sex that has had a severe sickness, as it is rare that they thoroughly recover. Such birds may look well, eat well, and appear healthy, but as a general rule they fail to produce desirable progeny. In breeding to renew a laying flock pullets should not be used if it can possibly be avoided. Where they are used they should be mated with a second-season male bird.

I would again emphasize that in breeding profitable fowls the beginner in particular should aim at definite laying-types of purebred stock. The ideal types to strive for are contained in the New Zealand Utility-poultry Standards. Copies of this work may be had from the Publisher, Department of Agriculture, Wellington, at a cost of 3s., post free.

MANAGEMENT OF BREEDING-PENS.

The management of breeding-birds is of paramount importance. In the first place they should not be forced for eggs. The ration should consist chiefly of a variety of whole grains. The greater the variety in this respect the more fertile eggs will be produced, the stronger will be the germs, and the more easy will be the chickens to rear. It must be remembered that a chicken is built up of many constituents, and the food provided to the parent birds must contain those elements which are necessary for the formation of a properly developed chick. It is well known that the best hatchable eggs, and those which produce the strongest chicks, come from fowls which have a free range. If we could dissect a hen's crop after a day on free range we would not find any one particular class of food, but in most cases there would be a naturally balanced variety of different seeds, green-stuff, worms, and other kinds of insect-life.

On no account should breeding-stock be coddled. Strong, hardy chickens can only come from hardy parents. Where a good range or large run is available they should have access to it at all times, quite regardless of weather conditions. Of course, it must not be inferred that comfortably roomy houses, where the birds can exercise in comfort during extreme weather and when they prefer to remain indoors, are unnecessary. Indeed, the great bulk of the ration provided should be fed in deep litter to induce the birds to exercise, as a means of preventing fat-formation. Do not forget an abundance of green food; no bird can be maintained in a proper breeding-condition without it.

Care should be taken that the male bird does not get run down. He should be frequently dusted with a good insect-powder as a means of destroying parasitic life. If good dust-baths are provided the hens will usually keep themselves reasonably free from body-lice, but in the case of the male it is entirely different. He should be maintained at the top of his form at all times. When the bulk of the ration is fed in litter the male as a general rule will not scratch for his food to the same extent as the females, and as a result is apt to rapidly decline in weight. Where possible it is a good plan to remove the male from the hens and give him at least one good meal a day by himself.

THE TIME TO HATCH.

It should be the aim of every poultry-keeper to secure a fair supply of autumn and winter eggs. In order to secure these the pullets must be largely depended upon, and they must be hatched neither too early nor too late. In a general way, for the heavy breeds such as Orpingtons, Wyandottes, &c., July and August are the most suitable hatching-months, and for the lighter breeds August and September.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

WINTER FOOD-SUPPLIES.

As advised last month, the bees should require no further attention until the spring. If, however, the beekeeper has any reason to fear that his bees are in danger of starving they should be given a block of sugar-candy, unless combs of honey or candied honey from colonies known to be free from disease are available. Instructions for making sugar-candy were published in the August, 1922, issue of the *Journal.*

RENDERING WAX.

If the season's accumulation of wax has not already been melted up this should be attended to without delay, and the wax sent to a manufacturer of comb-foundation to be made up. If there is any quantity of wax to be melted up a wax-press of some description should be obtained—there are several good makes stocked by dealers in beekeepers' requisites. The press is necessary in dealing with large quantities of wax owing to the retention otherwise of much of the wax by the slum-gum, which is made up very largely of the discarded cocoons of successive generations of larvæ. Wax obtained from cappings or combs that have not been used for brood-rearing will not contain much foreign matter.

In the absence of a better equipment, wax may be readily rendered in a kerosene-tin on the kitchen-stove. Place the pieces of comb or cappings to be

reduced in the tin, and add sufficient water to cover them by a good margin; there is no danger of using too much water. When the wax is melted, remove the tin from the fire and place it in a sheltered place to cool. Do not hasten the cooling process by undue exposure, as slow cooling affords time for the heavier foreign matter to settle. When cool the wax should be taken out and as much as possible of the accumulated foreign matter scraped off. It should then be broken up and reduced to as small a compass as possible, placed in a bag of scrim or similar porous material, and melted again to remove the remaining particles of foreign matter. If the wax is not required for manufacture into foundation it will sell more readily if run into small moulds similar to patty-pans.

PLANTING FOR SHELTER AND BEE-FORAGE.

This being the planting season, any contemplated provision of additional shelter or forage for the bees should be attended to without delay. Tagasaste, commonly called "tree-lucerne," is a rapidly growing hedge-plant which can be recommended (if protected from cattle), as it yields an abundance of forage for the bees at a time when this is most valuable. As tagasaste does not transplant very readily the plants will require careful treatment when received from the nursery. If grown from seed the best results will be obtained by sowing in the early spring. To assist germination the seed should be first steeped in boiling water to which a little washing-soda has been added. Pour on the water and let it stand until quite cold; this will soften the seed, and, after straining, the addition of a little dry sand will separate it nicely for sowing. It is important that seeds treated in this manner be sown immediately.

The ground should be thoroughly worked (as for onions), and if, as is recommended, a double row is contemplated the width of the prepared bed should be not less than 4 ft. Sow the seeds three in a place, at a distance of 3 ft. apart and 1 ft. from the edge of the bed on either side, alternating the second row with the first—this gives 2 ft. between the rows. Thin out the plants when they have made sufficient growth to the strongest in each place.

Tagasaste is subject to the borer, and while it is an excellent temporary hedge-plant, it cannot be depended on to provide permanent shelter. The giant-growing privet (*Ligustrum sinense*) can be recommended for this purpose. It is a gross feeder, its roots extending in time several yards from the base on either side. For a single row a strip 3 ft. in width should be deeply dug, and if the ground is poor a liberal dressing of bonedust supplied. Select strong two- or three-year-old plants, and plant them 18 in. apart along the centre of the prepared ground. To secure a good bottom growth it will be necessary to clip the plants back fairly hard at the time of planting.

—*H. W. Gilling, Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

THE spring season, so far as seed-growing is concerned, may be said to begin with July in most places. Local conditions vary very considerably, and this must be allowed for; but in one respect all places are alike—the hours of daylight are beginning to lengthen at that period. Peas may be sown everywhere; for a start two kinds should be sown at the same time—an early kind for first use, and a second early to succeed them. After the first sowing one kind only should be sown at intervals of a fortnight, that being roughly the period of currency of each crop. Early potatoes may be planted in frost-free places.

Onions should be sown as early as possible, but not until a good seed-bed can be secured. The time when sowing is safe varies very considerably; those who can sow early in July have the best hope for a good crop. Varieties of keeping-types—Brown Spanish, Brown Globe, &c.—are the most valuable for spring sowing. Where early bulbs are desired sow White Queen. This variety will make good bulbs by the end of the year, but they are not good keepers, so only sufficient for summer and autumn use should be grown.

Carrots, lettuce, radish, parsley, cabbage, and cauliflower may be sown. Turnips should be left till August; if sown too early they bolt to seed without

bulbing. All species of herbs may be planted, also cabbages and cauliflowers. Celery for early crops may be sown under glass. Henderson's White Plume is the best variety for early use.

Asparagus.

The quality of asparagus depends on the strength of its growth; stout heads grown quickly are the most succulent. Nitrogen being the element that promotes vegetative growth, it follows that nitrogen in some form is the element of the greatest importance in asparagus-culture. If stable or other animal manure is applied in large quantities it answers quite well, but moderate quantities are not effective. The method of planting also has a bearing on the matter. If the plants are set in rows far apart, in conformity with modern practice, much less manure per plant is required than is the case with the old-fashioned beds, where the plants are in close competition with each other. In either case some added nitrogen would be beneficial; in the latter it should be regarded as indispensable, and more especially as the nitrogen-content of animal-manure is practically an unknown quantity to the user, and may amount to very little.

Nitrate of soda is the best form of nitrogen for asparagus, because it is immediately available—it has an immediate effect on growth. Phosphates and potash are also required, but in smaller amount. A good dressing of wood-ashes or the remains of rubbish-fires will supply all the potash needed. Failing this material sulphate of potash may be applied, using 1 oz. per square yard. Blood-and-bone will supply phosphate from the bone, and slowly available nitrogen from the blood. About 4 oz. per square yard should be used. All except nitrate of soda may be applied at once. Nitrate of soda, being highly soluble in water, is quickly washed down beyond the reach of the roots, and therefore should not be applied till the roots are active. The roots being active some time before top-growth is visible, about the middle of August is a good time to apply the nitrate. Comparatively large amounts can safely be used, up to 8 oz. per square yard for close-planted beds. This amount would kill slugs and most weeds, but would not injure the roots of asparagus.

SMALL-FRUITS.

Gooseberries.

Bushes should be trained up so as to secure a clean trunk between the surface of the soil and the first branch. The clean trunk should be at least 6 in. high, and a few inches more is better. To secure this all the buds on the cutting except three or four at the top should be cut out. If this has not been done it should be attended to before a young bush is planted. Bushes with branches coming from beneath the surface are a source of never-ending trouble. It is impossible to form a good bush, pruning is made difficult, and if weeds with perennial roots are present it is impossible to get them out. Besides these troubles, the work of cultivation around them is difficult and slow, causing waste of time and probably neglect.

Pruning: Young bushes should be started with three main branches evenly disposed around the trunk. These should, if they are strong, be reduced to about 10 in. If the shoots are feeble cut them down to near their base to induce strong growth. If three branches evenly disposed cannot be secured, and four can, keep the four and prune a few inches higher than advised for three branches. If only two strong branches can be secured cut these two down to about 6 in. In future years an endeavour should be made to duplicate the leading branches so as to work up an evenly formed bush. In dealing with an established bush it should be understood that although every young shoot and twig will bear fruit, as well as spurs on older wood, a good crop is not obtained by having a multiplicity of young twigs, but by securing a balance between root and top that will ensure proper development of the fruit. In other words, a multiplicity of shoots and twigs will result in a large number of berries. Judicious thinning of the wood will reduce the number, but the individual berries will be much finer, and the result a much more profitable crop. The object, then, is to prevent undue crowding. Thin the growths so that gathering can be easily done, and that will be about the proper balance. Strong young shoots that are left should be merely tipped. All other young twigs should be cut according to strength, the weakest being reduced to short spurs. All twigs on the lower part of the bush should be reduced to spurs, and all strong shoots on the inner part of a bush should be broken or cut right out so that they cannot break again.

Red Currants.

Red currants bear fruit on spurs on wood that is at least two years old, never on young wood. The correct method of training and pruning is to lead up main branches as described for gooseberries, and prune all young growth back to spurs about ¾ in. long. An open centre should be maintained, so that the sun may shine on every part, otherwise the spurs on the lower part will become barren. Of course, fruit will be produced if the bush is allowed to grow more or less wild with no systematic or correct pruning. The fruit, however, will soon be borne only on the upper and outward parts of the bush, and this will be neither satisfactory not profitable.

Black Currants.

The black currant bears fruit on the young wood and also on spurs on the old wood. In former times the training and pruning practised was the same as for red currants. The borer trouble has caused a revision of methods, and the present practice is to look to young wood to produce the greater bulk of the crop. When the cuttings are made all the buds are left on ; this causes shoots to break up from below the surface—gives the bush, in fact, what is termed a stooling habit. If a branch gets borers in it, it can be cut down, and a new one takes its place. Cutting down a branch causes the sending-up of new shoots, and so the stooling habit continues. The main branches are allowed to take any position they happen to come in, a hollow-centred bush not being wanted. Pruning consists in the removal of any kind of wood to prevent undue crowding, and just tipping the young shoots to remove the portion that is not thoroughly ripened.

—*W. H. Taylor, Horticulturist.*

LIST OF QUALIFIED VETERINARY SURGEONS.

THE following list of qualified veterinary surgeons known to be residing in New Zealand is published for the guidance of stockowners and for general information. In the event of the name of any properly qualified veterinarian being omitted it is requested that he communicate with the Editor, giving particulars of his qualification, in order that the necessary steps may be taken for the inclusion of his name in the next published list.

Aberdeen, C., L.V.Sc. (Melbourne), Wanganui.
*Ashe, G. G., M.R.C.V.S., Christchurch.
*Barnes, A. W., M.R.C.V.S., Hastings.
*Barry, W. C., M.R.C.V.S., Auckland.
Bayley, A., M.R.C.V.S., Hawera.
Begg, W. F., M.R.C.V.S., Te Awamutu.
*Blair, W. D., M.R.C.V.S., Invercargill.
*Blake, T. A., M.R.C.V.S., Masterton.
Brodie, A. M., M.R.C.V.S., Hastings.
*Broom, G., M.R.C.V.S., Gisborne.
Burton, S., M.R.C.V.S., Hamilton.
Carbury, H. W., M.R.C.V.S., Otorohanga.
Cockroft, J. E., M.R.C.V.S., Feilding.
*Collins, W. T., M.R.C.V.S., Wellington.
Crossley, F., M.R.C.V.S., Palmerston North.
Cunningham, T., M.R.C.V.S., Oamaru.
*Danskin, J., M.R.C.V.S., Dunedin.
*Elphick, E. E., M.R.C.V.S., D.V.H., Wellington.
Glover, F., M.R.C.V.S., Hamilton.
*Hickman, A. J., M.R.C.V.S., Auckland.
Hankin, T. H., M.R.C.V.S., Pukekohe.
*Haugh, P., M.R.C.V.S., Petone.
*Howard, E. C., M.R.C.V.S., Wanganui.
Johnson, A. A., F.R.C.V.S., Christchurch.
*Kerrigan, J., M.R.C.V.S., Christchurch.
Kyle, H. S. S., G.M.V.C. (Melb.), Templeton.
*Lawson, J. N., B.V.Sc. (Sydney), Wanganui.
*Lukey, E. J., B.V.Sc. (Melbourne), Christchurch.
*Lyons, J., M.R.C.V.S., Auckland.
*Mackenzie, A., D.V.S.M., M.R.C.V.S., Hamilton.
*Marsack, H. L., V.S. (Ontario), Auckland.
Marshall, D., M.R.C.V.S., Balclutha.
Martin, H. E., M.R.C.V.S., Christchurch.
McLeod, J., M.R.C.V.S., Christchurch.
*Meade, R. H., M.R.C.V.S., Palmerston North.
Miller, J., M.R.C.V.S., Invercargill.
*Paterson, A. M., M.R.C.V.S., Timaru.
Quinnell, W. C., M.R.C.V.S., Wellington.
*Reakes, C. J., M.R.C.V.S., D.V.Sc., Wellington.
*Reid, H. A., F.R.C.V.S., D.V.H., F.R.S.E., Wellington.
Ring, W. C., V.M.D. (Penn., U.S.A.), Ellerslie.
Siddall, E. L., M.R.C.V.S., Opotiki.
Simpson, C. S., M.R.C.V.S., Auckland.
*Snowball, W. D., M.R.C.V.S., Dunedin.
*Stafford, J., M.R.C.V.S., Christchurch.
†Stapley, W., M.D., D.V.Sc., M.R.C.V.S., Cambridge.
Taylor, H. C., M.R.C.V.S., Dannevirke.
Taylor, J. B., M.R.C.V.S., Waverley.
Taylor, W. G., M.R.C.V.S., Wellington.
Ward, J., M.R.C.V.S., Katikati.
*Wood, R. B., M.R.C.V.S., Waitara.
*Young, A. R., M.R.C.V.S., Wellington.

* Officers of the Department of Agriculture. † Not practising as a veterinary surgeon.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

DRENCHES FOR YOUNG SHEEP.

T. DAVEY, Mahanga, Wairoa :—

In the *Journal* for April (page 215) is given a stock solution for drenching hoggets. As I have been using bluestone and carbonate of soda for some years now I would like to know if I am doing the right thing. I mix 9 oz. of bluestone and 9 oz. of soda in 4 gallons of water, and give each hogget 2 oz., commencing to dose them at weaning-time. The chief trouble in this district is stomach-worms—small white worms and tapeworms.

The Live-stock Division :—

Your solution works out at 13½ grains to the dose. For weaners we would say that this dose is excessive, though about right for hoggets (twelve months old). The United States Bureau of Animal Industry recommends a dose of 6 grains for lambs (three to twelve months). Without a change on to clean pasture and nourishing food, however, treatment is wasted.

EFFECT OF FEEDING ON BUTTERFAT TEST.

"CURIOUS," Te Hana :—

With regard to test of cows for butterfat, could you kindly tell me if feed makes any impression on the test, and does extra-good feed only affect the quantity? In other words, would, say, a four-test cow increase her test by special feeding?

The Dairy Division :—

If a cow is well fed for some time prior to calving, this feeding may influence the test for a limited period, and until the cow reduces her flesh to normal working-condition. Outside this our experience points in the direction of extra feeding having little if any influence on the test of the milk. The effect of liberal feeding on the quantity of milk given is, of course, widely recognized.

SCALDING OF PIG CARCASES.

"QUESTION," Kawhia :—

Could you advise me as to the best method, temperature, &c., for scalding pigs after slaughtering?

The Instructor in Swine Husbandry :—

First see that the carcase is well bled. In preparing the scald arrange for a temperature of 150° to 160° F. For a small pig use the former, and a large pig the latter. Above this temperature there is a danger of setting the hair. It is advisable to use a thermometer. Keep the carcase moving in the trough for one minute, and then try the hair on the feet and ears. If easily removed the scald is about right, but to be on the safe side try the hair on the flank, as this is the hardest to remove. If it comes away freely commence scudding at once. It is advisable when the process of scalding is done in the open air to raise the temperature two or three degrees higher than stated, so as to allow for the cold air, also for lowering of the temperature of the water when the carcase is submerged.

GROWING LUPINS FOR SEED.

C. JESSON, Rotorua :—

I intend growing about 2 acres of white lupins for seed purposes, and shall be glad of a little information as to sowing, manuring, and harvesting.

The Fields Division :—

Lupins for seed should be sown in the spring as soon as danger from frosts is over. Sow in 14 in. drills at the rate of $1\frac{1}{4}$ bushels per acre. Superphosphate, 1 cwt. per acre, drilled with the seed would be beneficial. The crop should be harvested with a mower fitted with a short knife, and the cut material should be forked back as it is cut to prevent the horses treading on it and knocking the seed out. When dry it should be stacked and then left in the stack about six or eight weeks before threshing. The average yield of seed is about 25 bushels per acre.

NON-BEARING PEAR-TREES.

H. WIGMORE, Mercury Bay :—

I have two pear-trees, a William Bon Chretien and a Packham's Triumph, and neither bears any fruit, although they have blossomed for several years. Would you tell me if those varieties are self-sterile, and, if so, what kinds would be required to fertilize them? I have twenty-seven hives of bees, so do not think there can be any fault in that way. The trees are six or seven years of age.

The Horticulture Division :—

Special pruning methods are necessary to bring pear-trees into bearing at an early age; they do not, as a rule, fruit so early as do apples. You give no indication as to what growth the trees have made, nor of the pruning done. It frequently happens that trees that make heavy growth may blossom but fail to set fruit, because the strong growth made diverts sap from the flowering portions of the tree and the blossoms are weakened. If the trees are making strong growth, do no pruning for a year or two. This will cause the cessation of strong growth and promote the development of fruit-buds. The Bon Chretien pear is self-fertile, therefore the want of cross-fertilization would not account for it not bearing. It is not known whether Packham's Triumph is self-fertile or not. Authorities who have investigated the matter state that any two varieties will pollinate each other if their flowering-period is practically the same, and that is the case with Bon Chretien and Packham's Triumph.

CONTROL OF RAGWORT.

J. B. T., Dunedin :—

Would you kindly inform me if it is worth while cutting down ragwort if it is in its yellow flower? I commenced to cut some on my place and was told by a neighbour that I was simply wasting my time, as the cut plants would ripen and seed.

The Live-stock Division (Noxious Weeds Inspection) :—

For effectively controlling ragwort, where it is not possible to well stock with sheep, when the plant is young frequent cutting must be resorted to before it flowers, thus preventing the growth of leaves. If flowering of the weed is permitted, and it is afterwards cut down, there is no doubt sufficient sap in the stem to mature a proportion of the seed. In such cases and where the weed is only on small areas much good might be done by either pulling up the roots or by cutting the plant beneath the surface, or by cutting down, gathering, and burning it. This, however, should be done at least in the early flowering stage, and not when the seed has matured and shed.

TUTU IN RELATION TO CATTLE.

H. A. ALDERSON, Christchurch :—

Is there any known treatment for poisoning by tutu, and what is the best way to eradicate the plant? Do cattle usually eat it when not particularly hungry?

The Live-stock Division :—

A comprehensive reply in regard to the treatment of animals poisoned by tutu was given on page 492 of the *Journal* for June, 1917. The eradication of tutu is often a very difficult matter. If the plants are cut the underground stems shoot up again rapidly. If there is only a small quantity to be dealt with the plants may be grubbed out, but if present in large quantities cutting and burning is the only method. After burning, grass-seed should be sown. It is very difficult to state definitely whether or not cattle generally will eat tutu when not particularly hungry. It is usually held that if there is an abundance of young grass available cattle generally will not eat tutu in large quantities, but some appear to be very partial to small quantities even when there is plenty of other feed, and these animals seem to gain some tolerance to the poison. The poison in tutu-plants is particularly dangerous when there are young shoots, and also when the plant is wet from rain or dew.

BLOOD-AND-BONE MANURE AFTER LIME.

L. McINNES, Marua :—

Will you please inform me if it is advisable to use blood-and-bone manure when sowing grass in a paddock that has recently been limed.

The Fields Division :—

Blood-and-bone may be used without being harmfully affected by the previous application of lime—especially raw ground limestone. If, however, quicklime is used, it is advisable to give the soil a good disking after the lime is applied; then, if the soil is moist, blood-and-bone may be applied with safety after a period of three to four days. You would be well advised to use 2 cwt. of superphosphate with 1 cwt. of blood-and-bone per acre when sowing grass in your district.

TARWEED IN HAY.

E. MULCARE, Ngatere :—

Is tarweed injurious to cows if chaffed with meadow hay and fed with molasses and concentrates? The hay contains a good deal of tarweed. Would it be advisable to feed out as hay, or would it be safe to chaff for winter feed?

The Live-stock Division :—

In the plant form stock will not eat tarweed (*Bartsia viscosa*), and there is therefore no danger in feeding stock with hay containing this weed. In the chaffed form, however, stock might eat it unnoticed; and while it is not definitely known that the plant is injurious to stock, there is a possibility of its being so, and we should not, on that account, recommend chaffing the hay containing it.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 2nd June :—

Peas.—Market firm for spot. Small sales reported of Maple at about 102s. 6d. per quarter. Limited demand for forward shipments. May–June shipments offered 81s., with buyers about 80s. For May shipments prices hardened recently to 77s. 6d. Tasmanian Maple scarce; May shipments offered 91s. 6d., buyers about 89s. Japanese Blue have declined further, spot selling at 21s. 6d. per cwt.; new crops August–September and September–October shipments 22s. to 23s. Limited demand for Tasmanian Blue at 19s. and New Zealand at 18s. *Beans.*—English supplies sufficient for requirements, and market quiet. New Zealand quoted spot, 50s. to 52s. per quarter.

WEATHER RECORDS: MAY, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

FROM returns already to hand for the month of May rainfall was in excess in all parts of the Dominion except the towns of Auckland, Inglewood, and New Plymouth, as well as the Southland District. The north-east coast of the South Island registered what so far constitutes a maximum for those parts, and this was chiefly accounted for by the downpours which fell between the 5th and 8th inclusive. The average for the stations within this region runs between 3 in. and 4 in. for the whole month, while some typical records for the four days in question show the falls which accounted for very heavy floods and much damage, as follows:—

Station.	5th. Inches.	6th. Inches.	7th. Inches.	8th. Inches.
Picton	1·86	2·45	3·21	0·88
Spring Creek, Blenheim	0·73	4·00	2·50	0·05
Avondale	0·63	3·20	2·25	0·82
Hapuku, Kaikoura	2·00	13·57	10·31	0·82
Stag and Spey	3·60	19·69	10·83	2·67
Keinton Combe	2·28	14·40	10·17	1·88
Waiau	1·27	9·54	6·50	1·70
Highfield	1·50	9·55	7·78	2·26

The downpour was caused by a cyclone impinging on an anti-cyclone which passed in the south. The "edge" of the cyclone therefore accounted for these phenomenal rains. Hawke's Bay was threatened, but escaped damage.

Another disturbance passed in the north between the 18th and 21st, and an extensive westerly low-pressure followed, which accounted for very unsettled conditions, especially in and southward of Cook Strait.

The monthly temperatures recorded were above the average, and the general character of the month may therefore be described as dull, mild, and moist, the ground consequently being soft and muddy. Dairymen were glad that the season was practically over, and farmers and pastoralists had plenty to do in coping with damage and changes from the storm.

—*D. C. Bates, Director.*

RAINFALL FOR MAY, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
	North Island.			
	Inches.		Inches.	Inches.
Kaitaia	7·98	20	1·90	5·06
Russell	8·75	18	2·36	3·53
Auckland	4·12	26	0·58	4·42
Hamilton	4·72	25	0·84	4·41
Kawhia	4·99	23	0·62	4·77
New Plymouth	6·08	23	1·02	6·16
Inglewood	8·32	27	1·44	10·31
Whangamomona	7·27	27	1·23	6·59
Tairua, Thames	6·46	15	1·20	6·11
Tauranga	5·84	24	1·01	5·02
Maraehako Station (Opotiki)	8·60	21	1·34	4·82
Gisborne	7·06	14	2·30	5·50
Taupo	5·06	19	0·92	3·60
Maraekakaho Station, Hastings	6·61	19	2·19	3·87
Taihape	5·73	24	1·08	3·75
Masterton	8·96	20	2·30	3·91

RAINFALL FOR MAY, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall
North Island—continued.				
	Inches.		Inches.	Inches.
Patea	7·38	21	2·07	3·91
Wanganui	2·77	10	0·50	3·40
Foxton	4·31	17	0·94	2·38
Wellington	9·48	21	2·00	4·73
South Island.				
Westport	6·65	20	0·92	6·58
Greymouth	7·88	18	1·35	8·39
Hokitika	11·20	17	1·84	9·90
Arthur's Pass	16·86	14	2·90	10·93
Okuru, Westland	12·40	18	2·16	11·60
Collingwood	10·80	22	1·28	10·18
Nelson	10·32	21	3·42	3·12
Spring Creek, Blenheim	11·42	19	4·00	2·49
Tophouse	7·89	20	1·20	5·46
Hanmer Springs	19·68	14	6·72	3·52
Waiau	23·36	13	9·54	3·12
Gore Bay	9·27	11	5·15	3·43
Christchurch	6·80	17	3·40	2·56
Timaru	4·64	15	2·36	1·27
Lambrook Station, Fairlie	5·28	12	1·80	1·28
Benmore Station, Omarama	4·40	16	1·73	1·75
Oamaru	3·03	12	0·54	1·58
Queenstown	4·05	11	0·80	2·71
Clyde	2·07	11	0·60	0·97
Dunedin	4·48	10	1·26	3·22
Gore	1·96	14	0·35	2·84
Invercargill	2·20	18	0·40	4·64

REGISTRATION UNDER THE FERTILIZERS ACT.

The Fertilizers Act, 1908, requires every vendor of fertilizers to register his name and address before offering any fertilizer for sale, and thereafter on or before 1st July in each year. The Act defines a vendor as any person who, either on his own account or on behalf of any other person, sells in the ordinary course of his business any fertilizer. Storekeepers and others who act as agents for manufacturers and mixers of fertilizers are therefore "vendors." Vendors who carry on business at more than one address are required to register each address. It is sufficient if the addresses of all the branch establishments are stated on the head office registration forms.

It should be noted that, where a vendor has already registered a fertilizer during the current year, it is not necessary again to register the same particulars on 1st July. Many vendors are evidently under the impression that the registration year commences on 1st July, and that all fertilizers must then be registered afresh. This is not so. A second registration during any year (January to December) is necessary only where the previously registered particulars of a fertilizer require amendment.

On each sale of 5 cwt. or more the vendor must supply the purchaser with an invoice certificate showing the true particulars of the fertilizer as registered. All packages must be clearly and distinctly branded with the registered brand, provided that where any mixture is made up according to the written instructions of the purchaser it is sufficient to brand the packages "Special mixture."

Following are some of the more frequent errors made by vendors in completing the registration forms. Attention to these points will avoid a great deal of correspondence.

(1.) Omission or incomplete particulars of brands. The brand of each fertilizer must be clearly stated. Vendors frequently register fertilizsers as "Not branded." It is an offence under the Act to offer fertilizers (other than "Special mixtures" as above) in unbranded packages.

(2.) Entering the analytical figures in wrong column of the registration form. This is a frequent error on the part of agents and storekeepers, and is usually due to carelessness in copying the particulars from the manufacturer's invoice certificate. The Act provides for a penalty of £10 for failure to supply the correct particulars of any fertilizer.

Vendors are requested to fill in the columns "Name of Manufacturer or Firm from whom the Fertilizer was obtained," and "Price per Ton." This information is of great value to the Department, and it should be understood that the statement of selling-price does not commit the vendor in any way.

Every vendor of fertilizers should be conversant with the requirements of the Fertilizers Act, a copy of which, price 6d., may be obtained from the Government Printer, Wellington. Forms of registration will be supplied on application to the Chemist, Department of Agriculture, P.O. Box 40, Wellington, or to any office of the Department.

NEW ZEALAND MEAT-PRODUCERS BOARD.

REVISED SYSTEM OF ELECTION.

THE regulations of 8th June, 1922, under the Meat-export Control Act, governing the election of producers' representatives on the Meat-producers Board, have been revoked, and the following new regulations issued under date 7th June, 1923:—

1. In these regulations "the Board" means the New Zealand Meat-producers Board; "producers' representatives" means the persons to be elected pursuant to these regulations for appointment to the Board as representatives of the persons carrying on the business of the production of meat for export; "sheep-farmer" mean a person owning not less than 100 sheep, and includes a company or other corporation.

2. (1.) For the purposes of the election of producers' representatives a meeting of delegates (herein referred to as "the Electoral Committee"), elected as hereinafter provided, shall be held in the month of August, 1923, and in the same month in each year thereafter, on a day and at a place to be from time to time fixed by the Board. (2.) The Electoral Committee shall comprise twenty-five delegates to be elected by sheep-farmers.

3. (1.) For the purpose of the election of delegates the Board shall divide New Zealand into such number of electoral districts as it thinks fit. (2.) Each electoral district shall consist of one or more counties.

4. The Board shall prepare, or cause to be prepared, for each electoral district a list of sheep-farmers within the electoral district.

5. The number of delegates to be elected for each electoral district shall be determined by the Board, and shall, so far as practicable, bear to twenty-five the proportion that the number of sheep in the district bears to the total number of sheep in New Zealand.

6. (1.) No person shall be eligible for election as a delegate unless he has been nominated by a sheep-farmer and his nomination has been seconded by another sheep-farmer, and he has accepted nomination in writing. (2.) No person may accept nomination as a delegate for more than one electoral district. (3.) The form of nomination may be in the form No. 1 in the Schedule hereto. (4.) Nominations shall be received at such time and in such manner as the Board shall determine.

7. If no more persons are nominated as delegates in respect of any electoral district than are required for that electoral district they shall be deemed to have been duly elected.

8. (1.) If more persons are nominated as delegates for any electoral district than the number that has been determined by the Board for such district, then the electors of such district shall elect the required number of delegates by postal ballot to be conducted by the Board. (2.) If any question arises as to the validity of the election of any delegate it shall be determined by the Board, whose decision shall be final. The Board may in any case, if it thinks that the election of any delegates has been irregular, require a fresh election to be held.

9. (1.) The Electoral Committee shall meet in the month of August on a day and at a place to be fixed by the Board. (2.) At that meeting the Chairman of the Board shall preside. If the Chairman is also an elected delegate, but not otherwise, he shall have a deliberative vote on any question before the meeting. In the case of an equality of votes on any question he shall have a casting-vote, whether he is an elected delegate or not. (3.) The Chairman shall submit to the Electoral Committee for its consideration the report and balance-sheet of the Board's operations for the previous year.

10. (1.) No person shall be eligible for election as a producers' representative unless he has been nominated by a sheep-farmer and his nomination has been seconded by another sheep-farmer, and he has accepted nomination in writing. (2.) The form of nomination may be in the form No. 2 in the Schedule hereto. (3.) Nominations shall be received at such time and in such manner as the Board shall determine.

11. If no more persons are nominated as producers' representatives than are required to fill the vacant positions on the Board they shall be deemed to be duly elected.

12. (1.) If more persons are nominated than are required to fill the vacant positions on the Board, the delegates comprising the Electoral Committee shall proceed to elect by ballot from among the persons duly nominated the number of producers' representatives required. (2.) At such ballot no voting-paper shall be valid unless votes are recorded for the full number of persons required to be elected. (3.) If at such ballot two or more candidates have received the same number of votes, then, if it is necessary for the purposes of the election to determine their order of preference, and so often thereafter as it may be necessary to determine the order of preference of any candidates, a further ballot shall be taken of those candidates only: Provided that if no order of preference is indicated with respect to any candidates in two successive ballots the Chairman shall determine the order of preference by lot. (4.) Subject to the foregoing provisions, the number of candidates required to be elected who have received the greatest number of votes shall be declared elected.

13. The Secretary to the Board shall be the Returning Officer for the purposes of any ballot conducted for the purposes of these regulations.

14. The names of the persons who have been selected pursuant to these regulations as producers' representatives shall be forthwith forwarded to the Minister of Agriculture, and shall by him be submitted to the Governor-General for appointment.

SCHEDULE.

Form No. 1: Nomination of Delegate to the Electoral Committee.

............Electoral District.

Candidate [*Name in full, address, and occupation*]. Nominated by [*Name (signature), address, and occupation*]. Seconded by [*Name (signature), address, and occupation*]. Nomination accepted. [*Signature of candidate.*]

Form No. 2: Nomination of Producers' Representative on Meat-producers Board.

Candidate [*Name in full, address, and occupation*]. Nominated by [*Name (signature), address, and occupation*]. Seconded by [*Name (signature), address, and occupation*]. Nomination accepted. [*Signature of candidate.*]

Correction.—The Jersey cow shown on page 201 of the April *Journal* as St. Lambert's Bell is Lady Quickstep. Conversely the Jersey appearing on page 308 of the May issue as Lady Quickstep is St. Lambert's Bell.

THE NEW ZEALAND

JOURNAL OF AGRICULTURE.

VOLUME XXVII.

(July - December, 1923.)

GENERAL INDEX.

A.

B.

C.

D.

E.

F.

G.

H.

I.

J.

Vol. XXVII—No. 1. 20th July, 1923.

New Zealand Department of Agriculture.

THE NEW ZEALAND JOURNAL OF AGRICULTURE.

Published by direction of
The Hon. W. NOSWORTHY,
Minister of Agriculture.

Editor: R. H. HOOPER.

WELLINGTON:
BY AUTHORITY: W. A. G. SKINNER, GOVERNMENT PRINTER.
1923.

Annual Subscription, 6s. *Single Copy, 1s.*

THE NEW ZEALAND

DEPARTMENT OF AGRICULTURE.

ORGANIZATION AND FUNCTIONS:

Director-General: C. J. REAKES, D.V.Sc., M.R.C.V.S.

Assistant Director-Genera: F. S. POPE.

LIVE-STOCK DIVISION.—A. R. Young, M.R.C.V.S., Director.

Investigation and treatment of diseases of animals, and advice to stockowners. Inspection of live-stock, meat and slaughterhouses, rabbits and noxious weeds, and town-supply dairies. Instruction in poultry-keeping, swine husbandry, and wool-handling. Registration of live-stock brands.

DAIRY DIVISION.—W. M. Singleton, Director.

Instruction in manufacture of butter, cheese, casein, &c. Inspection of dairy factories and factory-supply dairies Advice regarding formation of co-operative dairy companies, and factory buildings and plant. Grading of dairy-produce for export. Supervision of herd-testing associations, and testing of purebred dairy cows. Registration of dairy factories, &c.

HORTICULTURE DIVISION.—J. A. Campbell, Director.

Instruction in production and preservation of fruit, and in viticulture. Direction of experimental orchards. Inspection of orchards, vineyards, nurseries, and imported fruit and plants. Instruction in beekeeping; inspection of apiaries; grading of honey for export. Advice regarding orchard shelter, hedges, &c. Registration of orchards, nurseries, and apiaries.

FIELDS DIVISION.—A. H. Cockayne, Director.

Agricultural instruction. Direction of experimental areas and co-operative experiments. Investigation and advice in agricultural botany, plant-pathology, entomology, and agrostology Identification of economic-plant specimens, insects, &c. Seed-testing. Hemp-grading and instruction. Grain-grading.

CHEMISTRY SECTION.—B. C. Aston, F.I.C., F.N.Z.Inst., Chemist.

Analysis of soils, limestones, fertilizers, stock foods, fodder plants, water, &c., and related advice generally. Chemical investigations relating to agriculture. Registration of fertilizers.

EXPERIMENTAL FARMS.—J. L. Bruce, Superintendent.

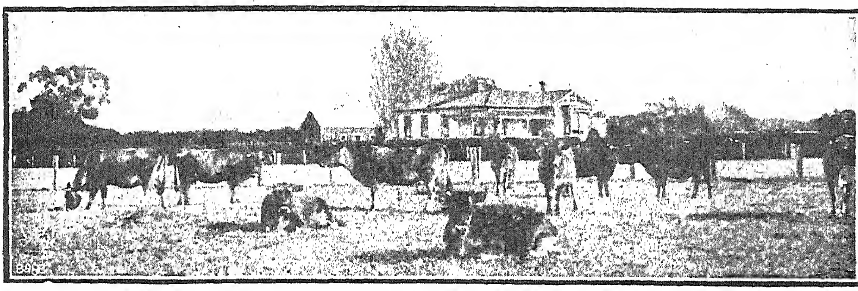
Ruakura (Hamilton); Weraroa (Levin); Moumahaki (Waverley); Waimaunga (Grey Valley).

PUBLICATIONS SECTION.—R. H. Hooper, Editor.

Edits and issues the *New Zealand Journal of Agriculture*, bulletins, reports, and other publication. of the Department.

The postal address in each case is "DEPARTMENT OF AGRICULTURE, WELLINGTON."

BRANCH OFFICES AT DISTRICT CENTRES.



The New Zealand

Journal of Agriculture.

VOL. XXVII.—No. 1.

WELLINGTON, 20TH JULY, 1923.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

I. MILLING-QUALITIES.

L. D. FOSTER, Analyst, Chemistry Section.

IN the growing of wheat, however much maximum-quantity production may be aimed at, it is the quality of the flour produced from the wheat which is of most value to the miller and the baker, and incidentally to the consumer. A good milling-wheat is one which produces the greatest quantity of flour of the best quality. Hence, being of good quality, or "strength" as it is called, such wheat is in greater demand, and consequently should bring a higher price.

Wheats, however, are often valued by their general appearance, weight per bushel, soundness, &c., and bought according to these valuations, not so much attention being paid to their capacity for producing large amounts of flour of good quality. As a matter of fact, good appearance is often associated with "weakness," and weight per bushel is not a sure indication of strength. And although, where these facts are taken into consideration, large yields are often associated with inferior strength, it should be remembered that it has been found possible in many countries to find and develop varieties especially suited to particular districts yet sacrificing little of yield to strength.

TABLE I.—MILLING TESTS OF NEW ZEALAND WHEATS (SELECTED RESULTS).

Laboratory Number.	Variety.	Locality and County.	Bran.	Pollard.	Flour.	Remarks on Yield of Flour.
			Per Cent.	Per Cent.	Per Cent.	
P 307	Pearl ..	Weedon's, Paparua ..	9·3	15·5	75·2	Very good.
P 382	,, ..	Frankton, Lake ..	14·4	11·3	74·3	,,
O 811	,, ..	Lincoln, Springs ..	12·3	13·9	73·8	,,
P 306	,, ..	Leeston, Ellesmere ..	11·5	16·1	72·4	Good.
O 812	Velvet (selected)	Lincoln, Springs ..	9·0	15·8	75·2	Very good.
P 294	Velvet ..	Dumbarton, Tuapeka	12·6	13·3	74·1	,,
P 262	,, ..	Windsor Downs, Waimate	11·1	15·8	73·1	,,
P 292	,, ..	Nenthorn (Moonlight), Upper Taieri	12·9	14·2	72·9	Good.
P 291	,, ..	Middlemarch, Upper Taieri	12·2	15·2	72·6	,,
P 290	,, ..	Ditto	12·9	15·3	71·8	,,
P 327	,, ..	Wrey's Bush, Wallace	12·3	16·6	71·6	,,
P 468	,, ..	Winton, Southland ..	15·6	12·9	71·5	,,
O 814	,, ..	Lincoln, Springs ..	13·5	15·7	70·8	,,
P 310	Hunters ..	Killinchy, Ellesmere	14·2	14·0	71·8	,,
P 295	College Hunters	Dumbarton, Tuapeka	13·0	13·4	73·6	Very good.
P 265	,,	Airedale, Waitaki ..	12·8	14·2	73·0	Good.
P 313	,,	Lincoln, Springs ..	14·8	13·5	71·7	,,
P 308	,,	Doyleston, Ellesmere	13·4	15·1	71·5	,,
P 383	Tuscan ..	Malaghan's, Lake ..	13·0	14·4	72·6	,,
P 379	,, ..	Lake	11·4	16·8	71·8	,,
P 381	White Tuscan	,, ...	14·0	13·8	72·2	,,
P 467	,,	Winton, Southland ..	13·7	14·8	71·5	,,
P 315	Solid-straw Tuscan	Annat, Malvern ..	9·5	16·3	74·2	Very good.
P 314	Ditto ..	Domett, Cheviot ..	11·0	15·2	73·8	,,
P 316	,, ..	Hawkins, Selwyn ..	12·2	14·5	73·3	,,
P 325	,, ..	Athol, Wallace ..	10·9	17·2	71·9	Good.
P 319	Purple - straw Tuscan	Greendale, Selwyn ..	14·4	13·7	72·2	,,
P 323	Victor ..	Kirwee, Malvern ..	11·5	12·5	76·0	Excellent.
P 321	,, ..	Horrelville, Eyre ..	12·7	11·8	75·5	Very good.
P 322	,, ..	Domett, Cheviot ..	10·9	14·7	74·4	,,
P 324	,, ..	Irwell, Ellesmere ..	13·4	13·1	73·5	,,
P 263	,, ..	Glenavy, Waimate ..	12·1	16·2	71·7	Good.
		Miscellaneous.				
P 260	Dreadnought	Kurow, Waitaki ..	11·5	13·5	75·0	Very good.
P 259	,,	Kia Ora, Waitaki ..	10·5	16·4	73·1	,,
P 431	Huron ..	Dumbarton, Tuapeka	13·7	11·4	74·9	,,
P 429	Marquis ..	,, ,,	12·4	15·2	72·4	Good.
P 432	Thew ..	,, ,,	14·6	14·3	71·1	,,
O 815	Burbank's Super	Flaxton, Rangiora ..	14·0	16·0	70·0	..

Of the nine samples of Velvet shown, three yielded very good amounts of flour, the one from Lincoln being excellent. The other samples produced good percentages of flour. On the whole the milling-qualities of Velvet are good, ranging from medium to excellent, with a good proportion of good and very good samples. It may be said that for the most part the better flour-yielding Velvet samples

come from the more southern districts. A notable exception to this, however, is the excellent amount of 75·2 per cent. obtained from the selected Velvet variety grown at Lincoln (O 812). A fact worthy of notice is that the commercial sample of the same variety grown in the same locality (O 814) gave 70·8 per cent. of flour.

The sample of Hunters grown at Killinchy yielded a good percentage of flour. College Hunters samples were received from different localities in the South Island. Of the samples milled, as shown in the table, one may be classified as very good, and three as good. The sample from Dumbarton gave the very good yield of 73·6 per cent. of flour, and one from Airedale 73 per cent. These samples, which came from widely distributed districts, do not show any very marked differences in their milling-yields, except that College Hunters grown at Dumbarton and Airedale gave better results than those from the other districts examined in 1922. Of this variety as a whole it may be said that for the year in which these samples were grown it yielded on the average a medium amount of flour.

Three samples only of Tuscan were received, a number too small to give much positive information; of these three, however, two from Lake County produced good percentages of flour — 72·6 and 71·5 respectively. White Tuscan is represented by two samples which gave good yields of flour—72·2 and 71·5 per cent. The first of these was also from the Lakes district; the other was grown at the Winton Experimental Area. Better results were obtained from Solid-straw Tuscan. Of the samples tested, three (from North Canterbury) gave very good yields of flour, and one (from Southland) was classified as good. From these results it may be fair to say that in 1922 Solid-straw Tuscan gave generally a good yield of flour. Purple-straw Tuscan is represented by a sample from Greendale, Selwyn County, testing 72·2 per cent. of flour, which is regarded as a good amount.

The variety Victor gave very interesting results. One sample from Kirwee (P 323) gave the excellent milling-yield of 76 per cent. flour, and three others very good yields—namely, those from Horrelville (75·5 per cent.), Domett (74·4 per cent.), and Irwell (73·5 per cent.). These again (see Solid-straw Tuscan) are all from North Canterbury. A sample from Glenavy, Waimate, gave the fair yield of 71·7 per cent. The average of the five samples is therefore very high, and Victor must be considered, so far as the 1922 figures show, as a variety usually yielding a high percentage of flour. More, however, will be said later regarding the strength of this variety.

There remain six samples which are grouped under the heading "Miscellaneous." Two samples of Dreadnought, both from Waitaki, yielded very good percentages of flour — 75 and 73·1. This is an interesting variety, and it is to be regretted that more samples of it were not received for milling tests. A sample of Huron gave the very good yield of 74·9 per cent. of flour. Marquis was a good wheat with 72·4 per cent. There was then a drop to Thew with 71·1 per cent. These results are interesting, and further reference will be made to them later.

Though the number of samples received in some cases was too small to produce reliable averages, the following figures are given for the totals of some of the varieties tested in 1922:—

Class.	Variety.	Number of Samples.	Average Percentage of Flour.
Pearl	Pearl	5	73·3
"	Velvet	10	72·4
Hunters	College Hunters	12	71·2
Tuscan	Victor	6	73·7
"	Solid-straw Tuscan ..	7	72·0

SUMMARY AND CONCLUSION.

Summarizing the results, it may be said that in 1922 the Lakes district produced wheats with good milling-qualities, while each of the three samples received from the Upper Taieri was good. The south and middle Canterbury wheats were on the whole very satisfactory in flour-percentage, out of the total number of samples tested two only not being classified as good. Those from north Canterbury reached an equally good standard, more than half of them giving good and very good percentages of flour.

Interesting results were obtained from several varieties not grown to any great extent in New Zealand, and this would suggest that experiments might be tried with these. Provided that their yields per acre were satisfactory, it might be found that they would be specially adapted to certain districts, yielding more satisfactory amounts of flour than some varieties now grown.

On the average the flour-producing quality of New Zealand wheats is shown to be very fair. But, naturally, it will be in the interests of the grower, the miller, the baker, and the consumer if that proportion of the wheats which is yielding not such a good average of flour can be eliminated and in its place the better varieties grown. This should be possible by the adaptation of special wheats to special localities, though what varieties are better adapted than others to this purpose can be determined only by actual experiment. It would appear that the average amount of flour produced by those wheats milling only about 71 per cent. could be increased by some 2 to 3 per cent. or even more. It is needless to point out how much such an increase would affect and improve the all-round value of the Dominion's wheat crop; especially is this so when one considers that an improvement of 2 to 3 per cent. on the gross yield of flour may actually represent an increase of 10 to 15 per cent. in net profits.

REFERENCES IN TEXT.

(1.) A. E. Humphries and R. H. Biffen: The Improvement of English Wheat. *Jour. of Ag. Science.* Cambridge, 1907, p. 1.

(2.) T. B. Wood: The Story of a Loaf of Bread. Cambridge University Press, 1913.

(3.) W. L. Stockham: Some Factors related to Quality of Wheat and Strength of Flour. *Bulletin 139, N. Dakota Exp. Station*, 1920.

(4.) J. ZINN: Correlation between various Characters of Wheat and Flour. *Jour. of Ag. Research*, 1922, p. 529.

(5.) H. F. ROBERTS: The Relation of Protein Content to Variety Types in American Wheats. *Jour. of Ag. Science*, 1920, p. 121.

(6.) F. T. SHUTT: Influence of Environment on Composition of Wheat. *Jour. of Society of Chemical Industry*, 1909, p. 336.

(7.) *Agricultural Gazette of New South Wales*, 1918, 1919, 1920, 1921.

(8.) *International Review of the Science and Practice of Agriculture, Rome*, 1922, p. 1331.

THE CALVING OF DAIRY COWS.

HINTS FOR FARMERS.

A. R. YOUNG, M.R.C.V.S., Director of the Live-stock Division.

PRELIMINARY MEASURES.

A FORTNIGHT or three weeks before calving-time dairy cows should be removed from fields where turnips or other winter forages of that class are to be had in large quantities, and placed in a clean, fresh grass-paddock with sufficient available shelter. The paddock should be as free as possible from rough conformation, especially swamps, and fences abutting upon steep gullies where there is a danger of calves slipping through. The cow's food should consist only of the grass she gathers, or if there is not enough of this to keep her in fair condition other suitable food should be supplied to cover the deficiency. A few days before calving a good laxative should be given. The animal should be kept dry and warm, but allowed plenty of opportunity for exercise.

Before calving, also, all the hair upon the tail except the brush should be removed with the aid of a pair of horse-clippers. The upper part of the thighs, right up to and around the root of the tail, should be similarly treated, while any long hairs upon the udder should also be removed. These parts should then be well washed with soap and water into which has been put a tablespoonful of disinfectant to a bucketful of water. Most of the standard disinfectants are useful for this purpose; also good sheep-dip preparations at the strength used for dipping.

NORMAL CASES.

When a cow is observed in labour one must not rush to the conclusion that she must be calved at once. Many farmers have so acted and caused much unnecessary pain and often extensive injury to the cow. Before attempting to assist a calver, first wash the hands and arms clean, using some disinfectant, then rub the hands and arms all over with vaseline, soap, or other clean lubricant. Having done this, introduce the hand gently and find out how things are progressing. Should the opening into the womb be too small to admit the hand, do not force matters, but after manipulating the small opening with the forefinger leave the animal for an hour or so. Then try again, using the same precaution as to cleanliness, but never judge when a small opening is found that it will necessarily take hours to sufficiently

open, as relaxation often takes place with extraordinary rapidity. Should there appear, however, to be plenty of room for calving, the water-bag may be broken and an examination made as to the position of the calf. If the two fore feet and the head can be felt well advanced into the external cavity (the normal presentation), given a roomy cow and an average calf, the operator may proceed to calve the patient in the usual way and be successful single-handed. If, however, there is any doubt about being able to calve the animal single-handed, do not touch her until assistance has been secured, as many a good calf and often the cow as well has been lost for want of sufficient assistance at the proper time.

After the calf is clear of the cow the first thing to attend to is clearing away any obstruction that may be adhering to the nose and mouth of the calf. Should it have some difficulty in getting its wind, moving its limbs and vigorously rubbing with a handful of straw will be of much assistance. Having got it to breathe all right, attention should be directed to the navel-cord. Usually this is broken and the bleeding stopped by contraction of the muscular part of the cord when the act of parturition is complete. Sometimes, however, it does not break, and in such case it should be tied with a clean piece of twine about 1 in. from the body, then the remainder cut off close to the cord, but not so close that the twine may slip off. After this is done, or when the navel-cord has broken in the natural course, make the whole of the part germ-proof by a liberal smearing with an antiseptic ointment. This should be carefully attended to, as the navel is the spot where the germs of such diseases as joint-ill gain access, although their results may not show for many days afterwards.

The calf may now be left until the cow has been attended to. The afterbirth need not be troubled about in the meantime unless that part of the cord attached to the cow is bleeding; if so, tie up the bleeding end at once. The cow should be offered a drink of water, with the chill taken off, into which has been stirred a couple of handfuls of oatmeal. Usually she will drink this greedily and be much refreshed. If the animal has come through a hard time a bottle of beer every few hours is one of the best stimulants. The cow should then be made comfortable; it will pay, and the sense of humanity demands that she be given every attention for at least a few days. Milk should be frequently drawn from the cow and a portion of it given to the calf. In no case should a cow be milked dry for a few milkings, but, on the other hand, never allow the udder to be overstocked. Follow the practice that would be adopted by the calf if allowed to suckle its mother. It wants a little at a time and often, and this suits the mother also.

MALPRESENTATIONS AND HOW TO DEAL WITH THEM.

The foregoing is a brief outline of what should be done in normal cases, but unfortunately there are often malpresentations of the calf. Of these there are a great variety, but only the most common will be dealt with here. It should always be borne in mind that one should never attempt to take away a calf until the calf and the cow are got in the most favourable position; to do otherwise is courting disaster. The malpresentation may be by the head and one leg, the head and

three legs (two fore legs and one hind leg or the leg of a twin), legs without the head, no legs and no head, the head alone, or the hind quarters coming first. These are the most common, besides which cases of monstrosities, too big a calf, or a dead calf will occasionally be met with. The procedure here recommended for dealing with some of these abnormal presentations will be of assistance in connection with any other condition not specially referred to.

If the head alone is presented it will have to be pushed far enough back to allow of exploration for the legs. In pushing the head back do not use too much force—just a steady pressure between the expulsion efforts of the cow—and keep the nose well up toward the back so as to be easy of recovery when wanted. Now feel for the fore legs, and when one is secured straighten it out and draw it into the external cavity. Before doing anything further it is advisable to tie a piece of clean cord around the fetlock and let the other end hang outside. In many cases this will be a wise precaution, because this leg may have to be pushed back in order to get at the other, and when found no time is lost in tracing the first one. Once they have been properly straightened out there is no tendency for them to double back. Having got both legs into a favourable position, carefully observe an important rule—*never to pull upon the legs until after the head has been got well forward* into the passage. Here assistance is useful to gently and steadily pull upon the legs while the other operator keeps the head advancing at the same time. If the calf is not coming freely work it a little from side to side, and when it is coming in the correct position never pull straight, but slightly inclined towards the udder. It will also be of advantage sometimes to slightly advance one leg and then the other, as this reduces the width of the shoulders. Meantime, whenever the head appears, keep relieving the skin of the cow from the head and body of the calf. When the head and only one leg is presented push the leg back, as already directed, while the other is being recovered. When more than two legs are coming, great care must be exercised not to put the wrong one back, as even in the case of only two fore legs presented it has sometimes been found that one belongs to one calf and the other to its twin. This is best determined by following up the legs with the hand until the joints are found; these will guide one as to fore or hind legs, and, as a general rule, when three legs are concerned the two foremost are the correct ones.

It is no uncommon occurrence to find only the two fore legs, the head being doubled back along the side of the calf or down towards its brisket. In this case the legs will have to be put back out of the way while one feels for the head. When found, place the forefinger into the side of the calf's mouth; this will give you a good hold to turn the head round, after which a good grip can be got and the lower jaw and the head brought into position. Then recover the legs. Sometimes the calf may be found somewhat upon its back; usually this can be adjusted, but, if not, the pull would in this case be upwards instead of downwards. If the hind quarters are coming first do not attempt to turn the calf, but just take it away in that position, first raising the hind quarters of the cow so that a slightly downward pull will be available. Where the tail only is presented the hind legs will be found doubled up, and it is a somewhat difficult matter to straighten them

out. Personally, I never try to do this until the calf is partly out, as the position they occupy does not offer any resistance to calving, but proceed as follows: Procure a piece of thin, clean, strong rope, such as a plough-line, and pass the end of this through the double of the leg, which would be the hock-joint; bring this end out, and then tie together both ends of the rope used upon the leg. This, when the same operation has been completed upon the other leg, will prevent one from possibly pulling upon the wrong ends, thereby undoing all the work. Now proceed to pull on both legs at the same time until the tips of the hocks appear in sight, then stop. Now introduce the arm and feel for one foot; place this in the hollow of your hand and ask your assistant to pull upon that leg only, still keeping the foot in your hand. The reason for this will soon become apparent, as when the leg is nearly out it will straighten itself with such force that but for your hand that part of the cow would probably be seriously injured. Repeat the same with the other leg, then proceed as already advised.

If by reason of the size of the calf or malformation a difficult case is in prospect the services of a veterinarian should be secured, and that before the cow has been subjected to the usual "Let me have a try" amateur. Should no veterinarian be within reach the only plan is to try the best you can with the aid of some experienced person, and if failure is evident, as is sometimes the case even when a professional man is employed, the cow should be mercifully destroyed.

I cannot recommend the taking-away of the calf in pieces unless an experienced man is employed; neither can I advocate the Cæsarean operation (delivery by cutting walls of abdomen) in the cow, even by professional men, unless in exceptional cases, as the operation and after-attention to the cow would in most cases be more expensive to the owner than the value of both cow and calf. When, however, the failure to calve is due to the size of the calf, and the chances are that both may be lost, the owner must decide which to try to save—first having made sure that the calf is still alive. If it is decided to destroy the cow the whole thing must be done expeditiously and finished before the heart of the cow ceases beating, otherwise the calf will die. This being so, everything required for the operation must be handy. The cow should first be placed under the influence of an anæsthetic. Then turn the animal quickly upon its back and make a long incision along the centre of the belly, extract the calf, and cut the navel-cord about 1 in. from the calf's body, after which slaughter the cow. If the case is an emergency one, and no anæsthetic available, the cow should be stunned, but not bled until after the operation is completed.

REMOVING A DEAD CALF.

When there is a lack of freshness in any discharge coming from the womb, and especially if such discharge is showing a certain amount of decomposition, the indications are that the calf is dead. It may be here mentioned that a cow may calve a live calf and still carry a dead one for some time after. In all cases where the calf is dead the following procedure should be followed before any attempt is made to remove it: Obtain a bucketful of warm water, into this dissolve a few ounces of soap, add a teaspoonful of disinfectant, then inject the whole of the

solution into the womb—the idea being to replace the water which has most likely escaped some days previously, leaving the calf dry. The injection acts as a disinfectant and greatly facilitates the expulsion of the calf. Before proceeding to remove a dead fœtus heavily smear the hands and arms with soap, butter, or other material as a protection against poisoning and an aid to eliminate the very persistent and disagreeable smell from these after the operation is complete. Should the abdomen of the calf be much swollen, open it with a hook-pointed knife, thus relieving the accumulated gases. In some cases, especially those of monstrosities, the limbs may have to be broken or the bones of the head crushed, but in no case should the skin be broken, else there is a likelihood of the cow being scratched internally, which under the circumstances would most likely lead to blood-poisoning.

THE CLEANSING.

All cleansing or afterbirth should be looked for and destroyed, whether healthy or not. However repulsive it may appear, it is a fact that a cow with an abnormal appetite will eat her own or another cow's cleansing and thereby endanger her own health. Cleansings, although they may be previously healthy, are rapidly attacked by disease-producing germs when exposed to the air. It cannot be too strongly impressed upon the stockowner that cleansings left undestroyed not only encourage stray dogs to come about the place, but are a grave danger to the general health of stock. It is not recommended that afterbirth should be removed immediately the calf is born, as it is beneficial to give the cow a chance to do this without much help, but it is strongly recommended that every cow should be washed out immediately after calving, whether she has cleansed or not. The reason for this is that the lower part of the womb is below the external opening even when the cow is lying down, the result being that although all the solid parts of the cleansings may have come away there is always left a small quantity of fluid material. This may rapidly decompose, especially during hot weather, and blood-poisoning result. No disinfectant need be used at this stage, only a bucketful of water which has been boiled and allowed to cool to blood-heat and into which has been dissolved about 2 oz. of soap.

When the cleansing is retained longer than, say, twelve hours it should be removed. Proceed to do this with the same precautions as those advised before calving. First wash the womb out, but now using a little disinfectant in the water. Then with the left hand pull gently upon the exposed portion of the membrane—a good hold can be secured by rolling it around a piece of stick—and with the right hand assist in freeing the membrane from the walls of the womb, without, however, using much force. Should one come across a small patch and be undecided as to what it is, the best course is to leave it alone, but washing-out should be continued every day until all discharge has ceased. If the smell is offensive use more disinfectant.

GENERAL AFTER-CALVING PRECAUTIONS.

The most successful period for the prevention of disease or for combating disease already established in the womb is within the first twenty-four hours after calving. After this contraction rapidly takes place, and the womb cannot again be effectively washed out until

another calving. To demonstrate this the writer some years ago carried out a number of experiments, using forced and gravitation injections of water containing colouring-matter, upon cows about to be slaughtered, after which the womb was carefully examined and the results noted. These confirmed the opinion just expressed, and clearly showed that the contraction of the womb does not effectually expel all foreign matter, but encloses it in such a manner as to prevent any washing-out proces reaching it. Therefore every newly calved cow should be washed out soon after calving, as directed. It can do no harm and will save the life of many animals. At the same time note that all stains of calving should also be cleansed off the cow, as these are favourable breeding-grounds for disease, which in time is liable to attack the healthy organs.

In conclusion, if the farmer wishes his cows to have a healthy recovery and every chance to again produce he should act on the principle that cleanliness comes first, both in regard to the cow and all appliances used.

POPLAR AND ELAEAGNUS WINDBREAK.

[*Photo by T. W. Brown.*

In several articles on shelter-belts and hedges that have appeared in the *Journal* mention has been made of the excellent windbreak formed by a combination of the Lombardy poplar and elæagnus. A good example of this combination, at the Central Development Farm, Weraroa, is shown in the accompanying photograph. There are two rows of poplars, the rows 5 ft. apart, with trees 2 ft. 6 in. apart in the rows. The elæagnus, planted at the same time as the poplars, is in the centre of the space between the two rows of poplars, the plants being 3 ft. apart. The poplars have been topped, but the elæagnus has not at any time been trimmed.

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

III. THE LARGER FRUIT- AND INSECT-EATING PERCHING-BIRDS (*PASSERES*).

J. G. MYERS, B.Sc., F.E.S., R.A.O.U., and ESMOND ATKINSON,
Biological Laboratory, Wellington.

THE first article of this series discussed briefly the general principles of economic ornithology, while the second dealt with the relation of the forest-birds to the problems of forestry in New Zealand. In this, the third article, it is proposed to commence a more detailed examination of the New Zealand birds from an economic standpoint, to discuss the pros and cons of each species, and, having decided which are beneficial and which injurious, to point out in a simple way how to distinguish friends from foes.

This is the more necessary since, although most country-dwellers have a fair knowledge of the commoner birds, the nests and eggs are much confused. Some agricultural associations, acclimatization societies, and local bodies make a practice of paying for " small birds' " eggs—a practice in which serious lack of discrimination is exercised with regard to the accepted eggs. Thus school-children are actually encouraged to take the eggs of beneficial indigenous birds in their haphazard birds-nesting, in mistake for those of injurious introduced species. We know, for example, of no society which discriminates between the eggs of the native pipit or ground-lark and the imported skylark, yet the former is wholly useful and the latter almost entirely destructive.

There exists, also, at the present time in New Zealand no book of any kind which deals with indigenous and introduced birds alike and affords means of distinguishing them. In the following pages the present state of our knowledge on all these matters will be summarized, but there must be years more of the most patient field observation before the material is available out of which a comprehensive manual can be built.

THE NATIVE CROWS, HUIA, NATIVE THRUSHES, AND SADDLEBACK.

The birds will be dealt with in order of affinity, and at the head of the list are placed the two New Zealand crows or kokakos—North and South Island species respectively. In a work of this kind these, on account of their great decrease under the influences of settlement and their present resultant scarcity, need not detain us long. Their large size and soft bluish-grey plumage relieved by the striking wattles —blue in the North Island bird and orange in the South—render them quite unmistakable; nor is their rich organ-like note, once heard, likely to be confused with that of any other denizen of the New Zealand bush. It is needless to state that their influence in the forest, as agents in the dispersal of the seeds of trees, is wholly beneficent.

Still less to be dealt with in a work treating of the present position in New Zealand are the huia and the two thrushes—North and South Island respectively. While it is uncertain that any of these are totally extinct, from an economic viewpoint they are of such extreme rarity that they are mentioned here only for the sake of completeness. The work of the huia was described in the second article. That of the thrushes, which, by the way, should never be confused with the introduced English song-thrush now so common, was comprised under the two heads of "insect-eating" and "seed-dispersing."

The sixth bird on the list, the saddleback, on account of its exceeding rarity may be dismissed in the same way. Suffice it to state that just as the introduced starling leaves no stone unturned in its indefatigable search for insects of all kinds in cultivated and pastoral country, so this handsome indigenous starling subjected every crevice and cranny of tree and log to the same searching scrutiny.

From the records of the past, and from what we know of the birds which still remain plentiful denizens of the forest, it is a safe assumption that all of these six species performed definite tasks in the economy of the forest which it would be fatuous to suppose can be as well accomplished either by the other remaining indigenous species or by the introduced birds, which are adapted only to the environment to which they were accustomed in their original northern home.

THE STITCH-BIRD, TUI, AND BELL-BIRD.

In the next natural group, which comprises the honey-eaters, there are four birds—the stitch-bird, tui, bell-bird, and white-eye.

The stitch-bird, though once very common, is now—like most of the group already mentioned—of extreme rarity, and is economically negligible. It was at one time doubtless one of the most important of the forest-flower pollinators in the North Island (to which it is confined). Like all members of this group, though primarily a honey-eater, it feeds largely upon forest berries and insects as well.

The tui (or parson-bird), by far the largest and most conspicuous of the New Zealand honey-eaters, is almost too well known to need description, but something must be said of its nest and eggs. The nest is wide (9 in. to 1 ft. across) but shallow, and generally has rather an untidy look owing to its being made of interlaced fine twigs the ends of which project in all directions beyond the general outline of the nest. Manuka twigs seem to be the most often chosen when they are available. The shallow cavity is generally lined with the dark scales from young tree-fern fronds. The eggs — three or four in number—are very fragile-looking, and white or pale pink in colour, with a few scattered pinkish-brown spots mostly at the larger end. They range from 1 in. to 1½ in. long by ¾ in. or more broad.

The value of the tui as a fruit and honey eater in relation to the forest has been spoken of in the previous article. No one familiar with the bird or its habits in the bush will deny this, but what may be again emphasized here is the work it does in pollinating the many species of *Eucalyptus* that are now being planted everywhere for timber, and thus assisting their spread.

It appears that the persecution of the tui is not confined to the bush itself, but that even those which venture to visit the gum plantations in settled areas are in some districts shot for gastronomic

purposes by Maoris. The decay of *tapu* and the spread of firearms have, generally speaking, turned the Maori into a serious enemy of all the forest-birds which are large enough for food.

The bell-bird, makomako, or "mocker" (an often-used corruption of the Maori name), is one of those native birds which, after showing a great decline in numbers, are now more than holding their own. The bell-bird, however, is much less familiar to most people than the tui, partly owing to its quite recent return to settled districts, and largely no doubt to its smaller size and less conspicuous colour. It is not much over 7 in. in total length (the tui being 1 ft. or more long), while its olive-green steely black and brown colour is very difficult to see compared with the glittering blues and greens of the tui's dark plumage and the white neck-tuft which shows so strongly against it. The nest of the bell-bird, like the tui's, is largely constructed of small twigs and moss, but is much smaller and neater, and is lined with feathers. The eggs are similar to those of the tui in texture, but are rather richer in ground-colour and in markings. They are nearly 1 in. long by almost ¾ in. broad. What has been said of the good work done by the tui in the bush applies almost equally well to that of the bell-bird, while in many *Eucalyptus*-planted districts the latter is the commoner bird of the two.

It should be mentioned here that there is often confusion as the result of the practice prevalent in many districts of calling the crow or kokako "bell-bird," and reserving for the true bell-bird the name of makomako, "mocker," or even that final corruption "mocking-bird."

THE WHITE-EYE (WAX-EYE, SILVER-EYE, RING-EYE, OR BLIGHT-BIRD) (*Zosterops lateralis* Latham).

The multiplicity of names bestowed on this little bird is sufficient evidence of its familiarity. Under one or other of these titles its olive-green head and tail, grey back, and pale under-parts tinged very beautifully with reddish, and, above all, the ring of white feathers round the eye, are probably well known to most people. Its numerous relatives are found over a large part of the eastern world and particularly in Australia, where our own white-eye also belongs, since its colonization of New Zealand was apparently accomplished within the memory of man. It first appeared in this country, in the neighbourhood of Wellington, in 1856, and from that centre has apparently spread almost all over both Islands. In the first spring of its arrival, according to Buller, the *tauhou*, or "stranger," as the Maoris called the feathered immigrant, was accorded a warm welcome on account of its energetic attack on the woolly aphis—then, as now, a difficult pest of apple-trees. Later on its attentions to cherries, plums, and other fruits led orchardists and the Press to revise their first impressions and to restrain the enthusiasm of their eulogy.

For the greater part of the year the white-eye consorts in twittering parties or flocks which work assiduously from tree to tree in their search for insects of all kinds. Like the birds which have been artificially introduced or "acclimatized," to use the expression of those who practise it, the white-eye seeks the wilder solitudes far less than do those birds which are peculiar to New Zealand. It frequents gardens, orchards, and the vicinity of cultivation generally. In winter the small parties are considerably augmented, and large flocks then

repair to the gardens of even the most populous towns. Even in summer small travelling-parties may occasionally be seen in the most thickly populated districts.

There are several birds, both native and introduced, similar to the white-eye in size, but the nest of the latter (Fig. 1) cannot be confused with that of any other bird in New Zealand. It is a basket-shaped structure, attached by the rim at several places to two or more twigs lying more or less in the same horizontal plane. Though it may rest against twigs lying below it, the nest is never dependent on them for its support, and may be therefore truly described as pendulous or hanging. It is very frail-looking, often showing the light through it, but owing to the skilful interweaving of the grasses, mosses, &c., of which it is built it is really a very strong structure. It is generally

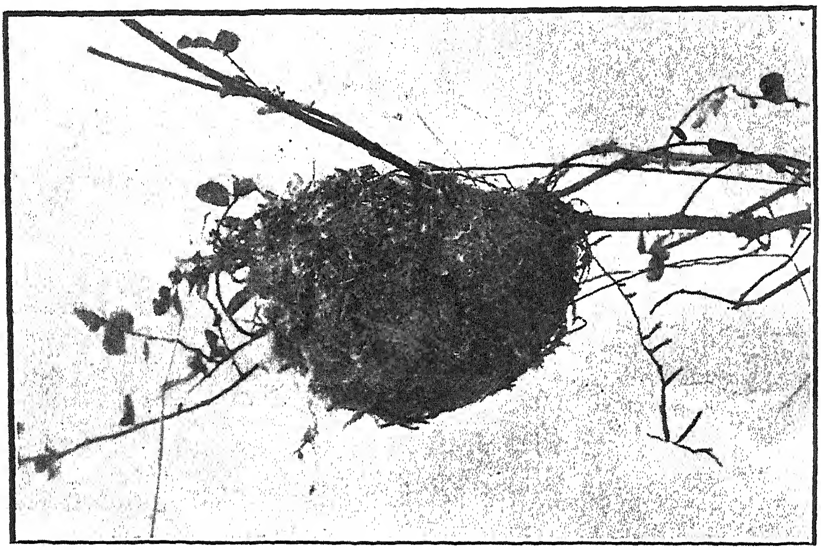


FIG. 1. NEST OF WHITE-EYE, SHOWING HOW IT IS SUSPENDED.
[*Photo by G. H. Cunningham.*

lined with grass, with the wiry leaves of the grass-tree (*Dracophyllum* spp.), and very often, particularly near settled areas, with horse-hair. The eggs, of which three or four are laid in the nest, average under $\frac{3}{4}$ in. in length. Their beautiful pale-blue colour combined with their small size distinguishes them from all other eggs found in New Zealand, except possibly those of the hedge-sparrow, which are larger and far deeper blue in colour.

The activities of the white-eye may be discussed under the following headings: (1) Pollination of flowers of trees, (2) dispersal of weed-seeds and tree-seeds, (3) damage to fruit, and (4) destruction of insects. From the economic standpoint (1) and (4) can be adjudged as wholly beneficial, (3) as wholly destructive, and (2) as a mixture of good and evil, between which a fair balance must be struck in considering the treatment the white-eye should receive from the cultivator.

The first of these activities has been dealt with generally in the second article of this series, in which the general importance of pollination by birds in the New Zealand forest was strongly emphasized. It is necessary only to point out here that while in the untouched forest itself the greater part of the work will probably still be carried out by the tui and the bell-bird, to which the native timber-trees had become more intimately adapted before the white-eye came to New Zealand, still in settled districts where these birds are less common the ubiquitous white-eye will doubtless perform good service. Even in the city it is a common sight in winter or late autumn to see white-eyes busily engaged on the flowers of the brush-wattle (*Albizzia lophantha*). In the bush itself the flowers of the various ratas (*Metrosideros* spp.) are visited for their honey, while their relative, the ornamental pohutukawa of our gardens and sea-coasts, receives the same attentions. So much for the white-eye's work in the pollination of trees and shrubs. This is a subject on which further and fuller observation is greatly needed, and it is one which can be studied by observation alone. In other parts of this investigation it is conceivable that the examination of birds' stomachs might be of some service; in this part it would obviously be useless.

In May last almost every patch of inkweed-plants (*Phytolacca octandra*) in the Auckland District was the centre of an animated scene owing to the parties of white-eyes which were feeding with avidity on the berries. In early portions of the district the bright-red bare spikes gave striking evidence of the quantity of fruit already eaten. Inkweed is dependent on birds for its spread; the hard black seeds could not easily be carried by any other method. It must not be supposed, however, that the white-eye is the sole exploiter of the juicy black fruit, for such introduced birds as starlings and thrushes certainly account for large quantities, while pheasants are said also to feed upon the berries. The blackberry—perhaps the most serious weed in New Zealand—is also, so far as the seed is concerned, spread solely by birds; but while there is little doubt that the white-eye will eat blackberries there seems no evidence to convict it of the major share in disseminating this pest. The blame for that must rather be laid at the door of certain of the introduced birds which are so overwhelmingly abundant in settled districts. The berries of another weed, the black nightshade (*Solanum nigrum*), are also eagerly eaten by the white-eye.

In the bush itself probably none of the smaller berries are disdained. It is here that the white-eye must be considered as an ally of the forester; so far as its forest activities are concerned, it does nothing but good.

It is when we come to the work of the white-eye in the orchard during the fruit season that there is need for all the good qualities of the species to vindicate it in the opinion of the fruit industry. There is scarcely any fruit which is not eaten, and some, such as figs, are hardly attacked at all by other birds. It is questionable, however, whether the greatest damage to fruit of all kinds is not the work of the blackbird, myna, starling, and thrush, which by reason of their great concentration of numbers in settled districts, and larger size, account for a greater quantity. There are indications that apples and pears are rarely attacked by white-eyes until the skin has first been pierced

by the stouter bills of these larger birds. The white-eye acts, as it were, as a jackal to the myna, blackbird, and starling, picking clean the cores left by them hanging or shaken to the ground. At such times, when engaged near the ground or on a scrap-heap or in a fowlyard pecking at a bone, the white-eye falls a frequent and easy victim to the household cat. An apple which has been "finished" by a white-eye is always to be recognized by the frequent survival of large portions, or even almost all of the skin, surrounding the clean-picked core, but between them an empty space.

When the white-eye turns its attention to stone-fruits it commits other damage than the destruction of fruit alone. Mr. G. H. Cunningham in a recent bulletin (No. 101, "Brown-rot") of this Department states, "Mr. J. C. Neill informs me that at Weraroa a small bird, locally known as 'silver-eye' (*Zosterops lateralis* Latham), is the cause of widespread brown-rot infection. With their beaks the birds commonly pierce infected fruits, and turn from these to healthy fruits, especially those showing colour, such as nectarines, which in turn they puncture, probably with a view of ascertaining whether they are edible."

In discussing the work of the white-eye in destroying those multifarious insect species which are summed up in the words "insect blights" it is difficult to overestimate its value to all who cultivate the land. Buller wrote, "I have opened many specimens, at all seasons, and I have invariably found their stomachs crammed with minute insects and their larvæ." The cabbage or turnip aphis, which sometimes infests crops of swedes, turnips, or allied plants to an incredible extent, is frequently cleared by this winged insecticide. In accordance with the principle that birds concentrate on the most abundantly available food, the presence of such a severe infestation as just described, when almost every leaf over acres is blue with aphides, is the stimulus which brings hundreds of white-eyes to the district where previously they perhaps have been but little in evidence. Here they remain until, from their viewpoint, the unexpected food-supply is exhausted, and, from our standpoint, until the pest is eradicated.

Whenever a set of advantageous conditions has so far favoured an insect pest that at last it breaks all bounds, as in the case of the cabbage-aphis referred to, or whenever a pest is introduced by natural or artificial means into a district where large quantities of its food plant have been hitherto uninfested, as in the case of the blue-gum scale (*Eriococcus coriaceus*), there the birds will be concentrated, as vultures follow the battle. In a large number of these cases the birds which concentrate on the pest are the white-eyes. With regard to the last case mentioned, that of the gum-tree scale, it must be admitted that the infestation in a new plantation is usually so overwhelming that the white-eyes are far too few to be of much service in clearing the trees. They are, however, one of the factors tending to right the balance of nature.

Another eucalypt insect eaten with avidity by the white-eye is the blue-gum psyllid (*Rhinocola eucalypti*) which infests the growing tips of young gums throughout the country.

The person, however, who must bear the whole cost of the white-eye's unfortunate proclivity for fruit is the orchardist, and it is not to be expected that he will be so altruistic as to maintain a corps of winged operators which will work solely in the interests of the farmer and the forester. Fortunately, it happens that it is in the orchard itself—the scene of its crimes—that the good points of the white-eye are displayed to the best advantage. A. H. Chisholm, writing in an Australian magazine on the relation of this bird to the orchardist, states that in Victoria it eagerly devours aphides of all species, codlin-moth, and pear-slug. A Hastings (Hawke's Bay) orchardist has described to us how he has repeatedly watched white-eyes eating woolly aphis. It is no exaggeration to say that nearly every major insect pest of the New Zealand orchard is in one stage or another of its existence searched out and eaten by the parties of white-eyes which subject every tree, every twig, and every crevice to the strictest surveillance. There can be no question that the value of the services rendered by the white-eye in the orchard alone in destroying insect pests throughout the year more than counterbalance the depredations committed during the ripe-fruit season.

It has been said that the value of insect-eating birds, of which the white-eye is one of our most conspicuous examples, is seriously lessened by the fact that they do not discriminate between the many beneficial insects which prey upon or parasitize our pests and the injurious insects themselves. F. E. L. Beale (1908) in the United States has answered this objection by showing that if birds are really indiscriminate in their taste the result will be a reduction of beneficial and injurious species by the same amount, thus leaving exactly the same proportion of useful species to attack the injurious species and maintaining the balance unaltered.

DODDER IN NEW-ZEALAND-GROWN CLOVERS.

PRECAUTIONS TO BE OBSERVED.

NELSON R. FOY, Biological Laboratory, Wellington.

ACCORDING to reports received from Great Britain and the United States, considerable trouble has been experienced through the occurrence of dodder-seed (*Cuscuta* spp.) in New Zealand white clover and cow-grass exported during 1922–23.

Previous to last year little had been heard of dodder in our clovers, and it was popularly supposed that the white clover and cow-grass rarely if ever contained this impurity. Whether it is that there is more of the dodder-plant growing in the clover crops, or that the bringing into operation of the new British Seed Act has made it more difficult for affected seed to gain entry unnoticed, is not easy to say. The writer is inclined to think that the sudden prominence gained by the dodder question is due in part to both of the suggestions put forward. The most unfortunate feature is that in many cases discovery of

the dodder does not take place until the seed reaches its destination, and then naturally the overseas buyers are not anxious to take delivery, as under the British Seed Act it is unlawful to sell clover containing dodder. Arbitration follows, and in many cases the seed has been returned to the shippers in New Zealand.

It is only fair to state that the New Zealand merchant does not knowingly ship such seed, but does so under the impression that it is "dodder free," such impression being gained from the analyses issued from the seed-testing branch of this Laboratory. Further, it is also fair to state that these analyses-reports issued are a true and correct statement of the purity of the *sample forwarded.* From this it might appear that the trouble is beyond remedy, but such is not the case.

When present, dodder is always in small quantities—from one seed in an ounce to one in a pound. Further, in New Zealand dodder grows only in small isolated patches, and it follows, therefore, that the seed will not be distributed evenly throughout the line. For example, the first two sacks examined may not contain it, and the third will. It will thus be seen that it is very possible to draw a sample—or, indeed, several samples—free from dodder, and then draw a further one which does contain dodder. In an actual instance three samples were drawn from a line of white clover—the first prior to shipment, and the other two (from bulk sample retained in New Zealand) after the line had been held up in Great Britain on account of dodder content. The first and second samples were dodder-free, but the third contained two seeds of dodder to the ounce. Each sample was approximately 1 oz. in weight. Such occurrences mean bad business for the merchant, and are tending to cause English seed firms to avoid New Zealand clovers—in both cases a decidedly unsatisfactory state of affairs.

The remedy—or at least nine-tenths of it—is in the hands of the New Zealand merchant and the grower; the other tenth must be left to chance. Particularly thorough sampling of export lines is absolutely essential. To obtain a thoroughly well-mixed sample one should be drawn from top, middle, and bottom of each sack of the line. This is especially necessary in the case of dodder, for, as already mentioned, the weed may occur only in quite small patches in the field, and only quite a few of the sacks may contain the impurity. The drawn seed should then be mixed, and as large a composite sample as is convenient drawn from it.

The foregoing may seem a somewhat laborious process, but it is the only way in which a thoroughly representative sample may be obtained, and a representative sample is essential if the analysis is to show the true state of the line as regards purity. Farmers themselves can also materially assist in maintaining the reputation of New Zealand clover by carefully examining their fields before harvesting, in order to ascertain whether any dodder is present.

Agricultural Exports.—The value of the agricultural products exported from New Zealand during the year ended 31st March, 1923, was £42,248,751, or 93 per cent. of the total exports in that period.

DAIRY-HERD IMPROVEMENT.*

SOME LEADING FACTORS.

W. M. SINGLETON, Director of the Dairy Division.

HERD-TESTING.

"By their fruits ye shall know them" is a saying not more true of human beings than of dairy cattle, and there is conclusive evidence that during the past two seasons our dairy-farmers have been more inclined to obtain an accurate idea of what amount of butterfat the individual dairy cow is delivering. Until more recent years comparatively little testing was done—partly because many dairymen were making a comfortable living without going to that trouble, and partly because many thought the Babcock machine could not tell them very much about their cows; in other cases, again, the releaser system of machine milking did not facilitate the taking of individual samples and milk-weights. In some instances it is possible that owners were rather afraid that some of their favourite cows might not make good, and as a consequence did not test. However, more dairymen are now facing facts, and in the past season some eighty-four thousand cows were tested for yield under the association system.

The influence of herd-testing is frequently very manifest during the second testing season for the herd. For example, among the herd-testing associations whose computations were made at the headquarters of the Dairy Division during 1920–21 and 1921–22 were some 218 herds which were tested in both these seasons. The yield of the average cow in these herds increased from 213 lb. to 253 lb. of butterfat, or about 19 per cent. Even granting that some portion of this increase may have been due to the fact that 1921–22 was a better season for grass, much of the improvement is undoubtedly due to knowledge gained as the result of the previous season's testing. In these herds the number of cows tested each season was very similar. Our figures show that often dairy-farmers reduce their herds as the result of testing, and still maintain the total yield of the herd. We also have data which show that in certain cases during a second testing season with only two-thirds of the previous season's herd the total butterfat produced underwent no reduction, while one dairy-farmer during his first testing-year milked twenty-three cows to produce as much butterfat as did sixteen which he milked two seasons later. Instances which bear out the same principle could be multiplied. The first testing season's returns were prejudiced by overstocking and therefore underfeeding.

MANAGEMENT.

Like children, dairy cows are perhaps more often "sinned against than sinning." The yield of the average dairy cow in New Zealand

* Substance of a paper read at the annual conference of the New Zealand Council of Agriculture, Wellington, July, 1923.

would be very materially increased with better feeding and attention, for there are many cows in our herds which if given all the feed they can consume and convert into milk would produce much larger credits for butterfat. Not all crossbred cows would respond as well as purebred, but our experience in testing purebreds goes to indicate that frequently it is the owner and not the cow who is the cause of poor production. One breeder in the early days of the certificate-of-record system entered over thirty purebred cows for test in one season. With so large a team it was found impossible to give the individual attention requisite for the production of good records, and the result was that only two of the cows produced as high as 400 lb. of butterfat—the season's work, so far as C.O.R. testing was concerned, being undoubtedly a failure. However, a number of the cows were retested during a later season and under better conditions, with the result that the butterfat records were increased as follows: Lot 1: First record, 351 lb.; second record, 581 lb. Lot 2: First record, 319 lb.; second record, 528 lb. Lot 3: First record, 304 lb.; second record, 566 lb. Lot 4: First record, 286 lb.; second record, 630 lb.

THE CULL-COW PROBLEM.

It is necessary that known low producers which have been culled should as far as possible be prevented from entering other dairy herds if the greatest improvement in the production of our average cow is to be safeguarded. Many methods of solving the cull-cow problem have been put forward, but so far no really successful way out of the difficulty has been found. Branding has frequently been urged, but is, or would be, difficult to enforce; and spaying has been practised by some with satisfactory results. The best solution in the end, however, may be found to be better breeding, which will lessen the proportion of low producers as results become more generally extended throughout our dairy herds.

INFLUENCE OF THE PUREBRED SIRE.

The influence of the purebred sire has been often stressed, and not without reason. In a herd of registered purebred dairy cattle it may be assumed that a purebred sire is at least "one-half the herd." This will, of course, depend on the breeding. In many purebred herds, and also in grade or crossbred dairy herds, a registered purebred sire of good breeding is more than half the herd. It is more prepotent for good or evil, as the case may be. The Dairy Division possesses tabulated records of ninety dairy cows and of daughters of these cows sired by purebred dairy bulls. The records were made at various ages, but correcting them to a basis of records at mature age it has been found that the records of the daughters are 28 per cent. higher than those of the dams. Possibly some of the daughters had better testing-conditions than their dams, as the owners may have profited by experience obtained while the dams were under test or after they were tested; but even if the percentage of improvement is reduced from 28 to, say, 10 there still remains a potent recommendation for better breeding.

It is becoming more generally recognized that the earning-power of purebred stock is considerably above that of scrub stock, even if

sales of progeny be eliminated from consideration. That this principle holds good with dairy stock in an exceptional degree will, I believe, be admitted. The fact is becoming evidenced in the increase in the proportion of purebred dairy bulls in use in dairy herds. During the 1917–18 season some 8·5 per cent. of the total bulls in such use were purebred Jersey, Friesian, Ayrshire, or Guernsey. During the 1921–22 season the percentage was 14·5, and a marked increase may be expected during the next decade. This extension of better breeding practice is one of the most encouraging factors among those affecting herd-improvement, largely because it is possibly the most potent factor operating in that direction. Given a reasonably good environment, including suitable feed, high-grade or purebred cows may be relied upon to produce from 25 to 50 per cent. more than scrubs. In one of our best herd-testing associations the lowest-yielding herd was headed by a grade Shorthorn sire, whereas all herds averaging 300 lb. of butterfat or over were headed by purebred dairy sires.

BREEDING METHODS.

The most popular system of breeding, and one which can be strongly recommended, is that known as line-breeding. This may be indicated as mating a grandson to granddaughters or great-granddaughters of the same animal by a different line. This class of breeding fixes type more slowly than inbreeding, but by means of the bringing-in of the outcrosses it enables the correction of defects in the strain whose blood lines are being concentrated. Line-breeding is a safe system, and does not require the consummate skill which inbreeding demands of the breeder so far as selection and culling are concerned. Inbreeding, which implies the mating of such near relatives as sire and daughter, son and mother, or brother and sister, accentuates inferior factors just as readily as good ones, and may be responsible for sterility, lack of constitution, or defective type, if such exist in the animal whose blood lines are being concentrated in the progeny. The Duchess family of Shorthorns developed sterility because the original Duchess was a "shy breeder."

HEREDITY AND ENVIRONMENT.

There has for years been a difference of opinion between scientists regarding the extent of the respective influence of heredity and environment. But so far as these affect the evolution of a good dairy herd there should be no difficulty. The best breeders believe in endowing the calf at conception with all the factors pertaining to heavy production which heredity can give it through good breeding. This, however, must be followed by suitable environment, such as will enable that calf, both before and after birth, to so develop that those hereditary factors may not be handicapped in any way, but may get free play to carry out that for which they were preordained by Nature. Thus heifer dairy calves in the hands of the best owners will not only be well bred, but grown on foods which will promote excellent growth, constitution, and capacity. If the young animal be underfed and small the heredity factors for high production cannot possibly produce the large yields of which they would be capable if housed in a well-developed body maintained by a strong constitution.

NEW ZEALAND AND DENMARK.

Denmark began cow-testing much earlier than New Zealand; in fact, I believe that some Danish dairymen were weighing the milk of individual cows before Wellington was founded in 1840. The first cow-testing associations in Denmark were started in 1895, and in 1921–22 there were tested through milk-recording societies some 230,000 out of a total of 1,184,000 dairy cows, some 20 per cent. thus being under test.

In the past 1922–23 season New Zealand has tested some 84,000 out of a total of 1,137,000, or about 7·35 per cent. We have a considerable distance to go yet along this line, but judging by the two last seasons' progress we are catching up very well indeed. The butterfat yield of the average Danish cow on test for the 1921 season was 261 lb. The yield in New Zealand for the 1921–22 season was some 245 lb. for cows on association test. This difference between the Danish and New Zealand average cow on test is not so large but that we may hope to overtake it, but personally I do not consider the overtaking of it a vital matter in the meantime. I consider it better to overtake the proportion of cows being tested, even although this might bring under test animals which would lower the average yield of cows on test.

We estimated the butterfat yield of the average cow in New Zealand during the 1921–22 season, taking those in milk and dry, as 168 lb. If one animal in ten be non-productive this gives the yield of the average cow in milk as 187 lb. The average butterfat yield of 660,000 cows supplying Danish co-operative creameries during 1920–21 was 198 lb., as nearly as can be calculated. It should therefore not be impossible for us to overtake the Danes. In the meantime dairying in New Zealand is in the evolutionary stage. In a young country such as this, where the dairy industry is extending each year, we cannot expect to attain to the production of the average cow of, say, Denmark until our cow population stabilizes in greater degree. The Dominion's carrying-capacity for dairy cows is increasing rapidly. New land is being steadily brought into grass, and top-dressing is improving older pastures. Our dairy-cow population has increased by over 50 per cent. in the last five years, the 1923 statistics showing another gain of 100,000 head.

When the dairy land in this country is all brought in as in Denmark, and when the number of our dairy cows shows little or no increase, we may reasonably expect greater improvement in their average yield. We can then cull the herds more severely, and the influence of better breeding and culling will be more generally demonstrated. I believe it to be only a matter of time until the New Zealand dairyman has the best-yielding average dairy cow in the world.

Importation of Sheep into Argentina.—Under a recently issued Argentine decree sheep for breeding purposes may be imported into Argentina from New Zealand and Australia even if they have been transhipped at Cape Town, provided that their sanitary condition is satisfactory and that they arrive with the regulation certificates.

WALNUT-BLIGHT.

INTRODUCTION OF IMMUNE VARIETY BY THE DEPARTMENT.

Horticulture Division.

THE ravages of the bacterial disease of walnuts (*Pseudomonas juglandis*) has rendered walnut-growing very precarious—so much so, indeed, that the Department does not think it wise while the present conditions obtain to encourage the extensive planting of the tree for the production of nuts. The present condition of the noted walnut-groves at Akaroa is well known. A few years ago these groves were a good source of income to their owners. During the past few years the blight has attacked the trees, and their production has dwindled to an almost negligible quantity.

This blight is not confined to New Zealand; it is a serious pest wherever walnuts are grown. Owing to its bacterial nature spraying is useless, and no other way of controlling it on affected trees has yet been discovered. The hope for the future appears to be in working the desired varieties on stocks immune to the bacterial disease. It has long been known that in California the native black-walnut (*Juglans Hindsii*) is used for the purpose. This species is a very strong grower, makes a very handsome tree, and is the favourite avenue tree in California. It is immune to the bacterial disease, and has been proved to be suitable as a stock. The nuts it bears are similar to other walnuts, but are smaller. They have exceedingly thick shells and only a small amount of meat.

Six years ago the Department sent an order to California for a bushel of these nuts, but in spite of repeated inquiries the nuts were not received till March of last year. On receipt of the nuts arrangements were made with the Nurserymen's Association for the nuts to be distributed to leading nurserymen, they agreeing to raise the trees and to use them for working commercial varieties. Under this arrangement a considerable number of trees should be available for purchase in the spring of 1924 or 1925.

The former practice was to raise trees from nuts. The resultant trees would bear fruit when from nine to twelve years old, except in cases where the trees, being in unsuitable soil, became stunted. They might then bear earlier, but would never make thrifty trees. Budded trees usually begin to bear nuts at the third year; in fact, nuts were frequently produced by young trees in the nursery rows. It will be seen that it pays to wait even a few years for budded trees.

During the currency of the Panama-Pacific Exposition, at San Francisco, in 1915, Mr. E. Clifton, the New Zealand Commissioner, sent us a small parcel of *Juglans Hindsii* nuts. Trees raised from these nuts are now growing at Te Kauwhata Horticultural Station, and in a few years' time should be a source from which nuts can be obtained for raising stocks.

EARLY SPRAYING FOR APPLE AND PEAR BLACK-SPOT.

THE STAGES OF BLOSSOM-DEVELOPMENT.

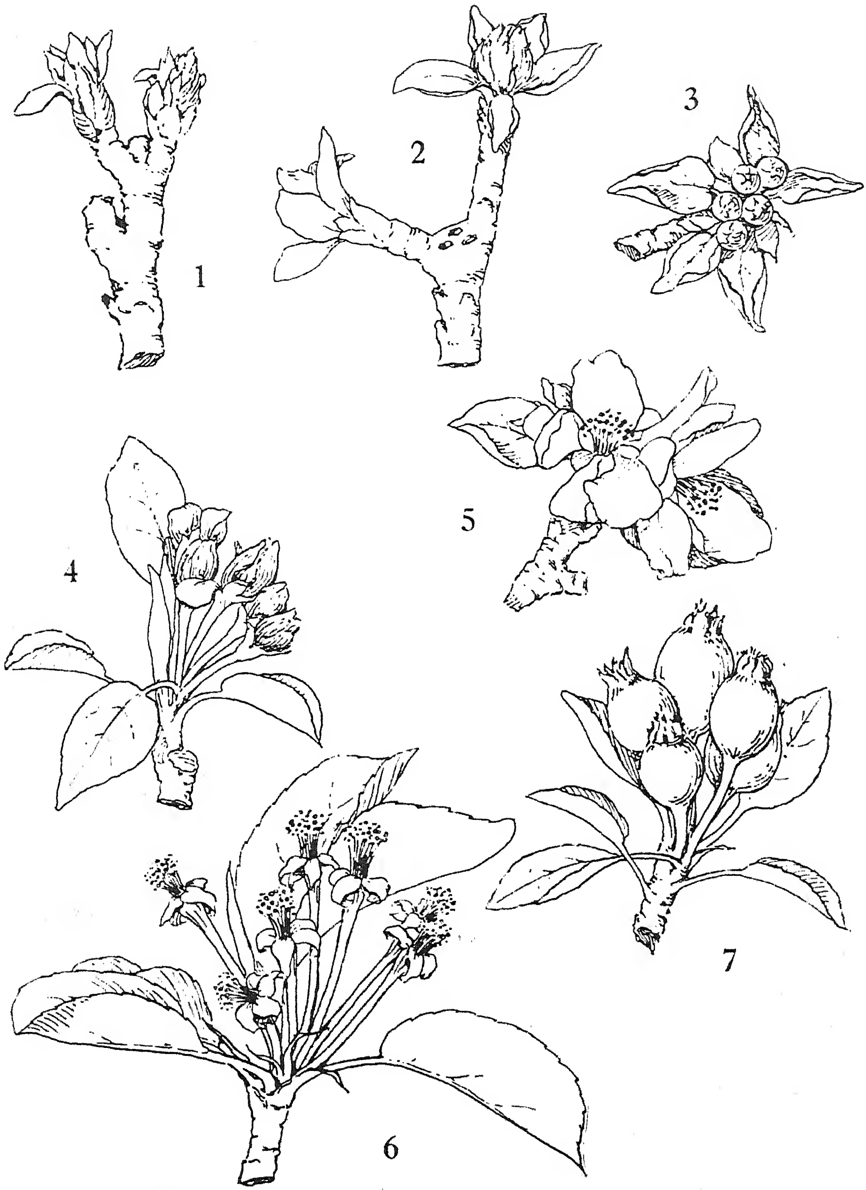
N. J. ADAMSON, Orchard Instructor, Thames.

SOME confusion seems to exist among fruitgrowers, particularly amateurs and those not long engaged in the industry, on account of the multiplicity of terms used to describe the various stages of apple or pear blossom-bud development, with a resultant doubt as to the correct strength of spray to apply at a particular stage. The accompanying drawings show the various distinct stages, and may be described as in the second column of the following spray schedule :—

Key Number of Drawing.	Stage of Development.	Lime-sulphur-spray Formula.	Bordeaux-spray Formula.
1	Green-tip	1–10	5–4–50 (1 and 2)
2	Tight-cluster	..	
3	Open-cluster	1–25	3–4–50 (3 and 4)
4	Pink	1–35	
5	Full-bloom	..	..
6	Petal-fall	1–100 to 1–120 (6 and 7)	..
7	Calyx-closed		

Bordeaux at the pink stage is liable to cause russeting, and its use then is advised only on varieties very susceptible to the disease and in unfavourable positions. If bordeaux is used at this stage an earlier bordeaux spraying could possibly be dispensed with. Due regard must be given to tenderness of variety and its liability to russeting. On less susceptible varieties and more tender ones usually two sprayings are advisable—one at the green-tip to open-cluster stage (either bordeaux, 5–4–50, or lime-sulphur, 1–10 to 1–25, according to stage of bud-development), and one at the pink stage (lime-sulphur, 1–35). Subsequent sprayings on all varieties would be lime-sulphur. Probably some slight adjustment in these spraying-strengths would be necessary to meet local requirements.

On account of some irregularity in the development of the blossom-buds it is necessary to take notice not of the most advanced, but of the majority in determining when to spray. For instance, at the pink stage some of the more advanced buds, principally those on the terminals, would be fully open, and at open-cluster a proportion of buds would be pink.



STAGES OF APPLE-BLOSSOM DEVELOPMENT.

(1) Green-tip; (2) tight-cluster; (3) open-cluster; (4) pink; (5) full-bloom; (6) petal-fall; (7) calyx-closed.

[*Drawing by N. J. Adamson.*

EXPORTATION OF EGGS.

POINTS FOR GUIDANCE OF PRODUCERS.

F. C. BROWN, Chief Poultry Instructor.

WITH the object of testing outside markets in order to relieve the local market when the latter is oversupplied, and to ascertain the best means of shipping eggs abroad, the New Zealand Poultry Association proposes to make a trial shipment of eggs to London in the coming spring. The shipment is to comprise 2,000 cases of fresh eggs of 30 dozen each, and a quantity of egg-pulp. It is anticipated that the returns will be payable, while the fact that large numbers of eggs are to be sent out of the country will undoubtedly have a strengthening effect on the local markets. Eggs produced in the winter months invariably give profitable returns, but it is the output of the more favourable periods for egg-production, which often has to be sold at a poor margin of profit, that it is intended to relieve. The export of a due proportion of these eggs is therefore most desirable, providing always that they have fair prospect of a payable market abroad.

In reckoning the prices likely to be secured for eggs on the London market, as a guide for comparing these with local values, sufficient consideration may perhaps not be given to the special quality of eggs required for the oversea trade. Thus, in considering the proposed trial shipment sufficient stress will probably not be laid on the fact that the eggs must be of undoubted quality, to say nothing of the risks by way of breakages in transit, &c. In this country top prices may often be obtained for eggs of poor quality, but on the London market it is entirely different. To compete successfully on that market not only must the eggs be fresh and spotlessly clean and inviting, but they must be uniform in size—namely, 2 oz. in weight—while eggs of different colours must be kept separate. The bloom, the colour of the yolk, and the size of the air-cell (this being an indication of age) must also be taken into account. Further, the eggs must be carefully graded, and packed in the best possible condition and style.

Such eggs would no doubt realize special payable prices at any period of the year on the local market, having regard to the fact that in too many cases the market rate is fixed just on eggs, quite irrespective of their size and age. Here the question arises, has the local market been fully exploited with eggs of the right quality? Be this as it may, the fact remains that the great bulk of producers at the present time in this country have yet to learn that great essential of marketing their eggs to the best advantage. Unfortunately, poultry-keeping at present suffers more through the weak system of marketing adopted than perhaps any other rural industry.

If the trial export shipment of eggs is to be a success it is imperative that distinct improved methods be adopted as compared with the manner in which the local trade is generally catered for. Failing

this, the producer cannot expect anything but second- and third-grade prices on the critical London market. Eggs, as in the case of any other exportable commodity, practically always involve a loss when they are marketed in poor condition.

POINTS FOR SPECIAL ATTENTION.

The points to which special attention should be given by producers in their endeavour to establish an export trade are as follows :—

Size.—Eggs to be not less than 2 oz. in weight, nor more than 2 oz. 2 dr.

Freshness.—Eggs to be strictly fresh. To ensure freshness they should be collected at least daily, or, better still, twice daily. Especially is the latter advisable when any hens are broody. On no account forward eggs for export which have been found in stolen nests outside. They may be fit for home consumption but not for export.

Where to keep.—Keep the eggs, after collecting, in a cool, dry place that is free from objectionable odours. Eggs are very susceptible to taint when kept in a room with vegetables, &c., and every care should be taken to prevent this.

Regular Marketing.—Eggs should be sent to the collecting-depot twice weekly, and oftener if circumstances permit. Remember that an egg commences to deteriorate from the day it is laid. A new-laid egg is full, the air-cell being scarcely perceptible. With age the air-cell increases in size. All eggs with the air-cell dried down to more than $\frac{3}{16}$ in. in depth will be rejected for export. Producers should never hold over eggs, as in doing so the eggs are apt to seriously depreciate in value and be rejected as stale eggs.

Cleanliness.—This means clean dry nests. For the nests use clean dry hay, straw, or other suitable material ; renew the material frequently, and always whenever it becomes wet or soiled.

No Washing.—Eggs for export should not be washed, as it reduces their keeping-quality. It also removes the desirable natural bloom, giving the eggs an old stale appearance. Egg-washing can be reduced to a minimum by keeping the birds under cover when the runs are wet, and by keeping the nests clean and sanitary, together with frequently collecting the eggs. Any dirt on an egg when it is collected should be at once removed by means of a dry cloth. If this method fails, a slightly damped but not wet cloth may be used. A good appearance suggests high-class quality, which is an essential in securing best returns and establishing a profitable connection on a market. A good article should look a good article. It is important that no egg be exported with even a spot of dirt on it.

Infertility.—Only non-fertilized eggs should be packed for export, as a fertile egg will commence to develop and deteriorate much sooner than a sterile egg. This involves the removal of all males from the females. The male bird is not necessary for the production of eggs ; more and better eggs will be produced without him.

Shell-quality.—The quality of the shell has a considerable influence on the keeping-quality of an egg. A thick-shelled egg is most desirable

for an export trade, because it is less liable to infection than one with a thin shell, and because a thin shell is much more easily broken. Breakages are not only a direct loss, but indirectly cause loss on other eggs that get soiled with the contents of the broken egg. It should always be remembered that the loss through breakages will have to be borne by the eggs that survive during handling in transit. Further, as the size of the air-cell is usually regarded as the chief guide to the age of an egg, and as thin shells favour the rapid drying-down of this cell, it will be seen that such eggs much sooner become a doubtful article than is the case with thick-shelled eggs. Losses through thin-shelled eggs can be considerably reduced by keeping the birds well supplied with fresh crushed oyster-shell or burnt bone, and testing out all eggs with thin shells before forwarding to the collecting-depot. As a shell-forming material fresh oyster-shell is most desirable. Bleached shell, such as is often collected from the seashore, is not so good, as it neither produces the desired strength of egg-shell nor the desired bloom upon it.

Shape and Uniformity.—Eggs are produced in many different shapes. Long and narrow eggs should never be packed for export, nor should deformed and overlarge eggs, as they are not only liable to be broken in transit, but they also spoil uniformity of the line. Home markets can only be secured with eggs of high standard quality and which are uniform in all respects.

Yolk and White.—The condition of the yolk is an important matter. The yolks most desired are those of a reddish-yellow colour, not pure yellow. A pale sickly-coloured yolk is objectionable and unsuitable for export, whether it be eggs in the shell or egg-pulp. Good colour and flavour are largely influenced by the food supplied to the birds. This should consist of sound grain, plenty of green material, and untainted meat in moderation. The inclusion of yellow maize and lucerne or clovers in the ration will tend to produce rich-coloured yolks. Generally speaking, root crops, such as mangolds, &c., if fed to excess, will produce pale yolks and thin whites. The white should be firm and thick. The older the egg the thinner the white becomes. With a fresh egg, when being tested before a light, the egg-content will remain firm. Conversely, the contents of an egg with a thin white will be found to move when the slightest movement of the hand is made. Such eggs are next to useless for export.

Mustiness.—Mustiness probably causes more annoyance when using chilled eggs than all other things put together, for one musty egg broken into a mixture will spoil the whole. Producers are urged to seriously guard against musty eggs being packed for export. A stale egg can be detected by the candle process of testing, but a musty egg may pass the keenest of operators. Indeed, only the person with a keen sense of smell can distinguish a musty egg when broken. The most common cause of mustiness is dampness; therefore eggs should always be kept dry, which means dry nests. Contact with wet material or exposure to moisture or rain causes eggs to go musty quickly. It is of special importance when eggs are being taken to market that they should be protected from wet by a suitable rainproof covering. The common practice of allowing cases of eggs to stand uncovered on a railway-platform or in an open cart during rain is merely inviting

mustiness and making the eggs next to useless for export. Mustiness may also be caused by feeding damaged foodstuffs, such as mouldy maize, wheat, &c., while mouldy bread will have a similar effect.

"*Grass Eggs.*"—These are eggs showing a greenish discoloration. The overfeeding of rape is a common cause of this trouble in hen-eggs, while in the case of duck-eggs the feeding of acorns will bring about a similar undesirable condition. Grass eggs are absolutely unsuitable for export.

Packing.—Many cases of eggs are likely to arrive at the collecting-depots in a broken condition owing to improper packing, although a little care and attention on the part of the producer would prevent this. Never pack in rough-and-ready boxes with straw chaff, or breakages will be the result. Eggs packed in chaff are unsuitable for export in shell; besides they are useless for pulping purposes. The only safe course is to pack the eggs in wire carriers or in cardboard fillings which are made for the purpose. To ensure perfect condition it is necessary to pack the cases so that the contents cannot shift, no matter in what position the package is placed. Wood-wool pads, one placed on top, bottom, and centre of the case, will ensure this where cardboard fillings are used, while the case should be packed in such a way that there is a slight bulge in the centre of the lid. The lid should be nailed at each end, and the middle left free to create a springy condition. It is important that the crates be properly addressed, and the word "Eggs" stamped well over the box in order that the railway-men, carters, and others may see at a glance what the case contains.

GENERAL.

What applies in the case of eggs in the shell intended for export applies with equal force to eggs intended for egg-pulp. The same great care should also be exercised with all eggs intended for consumption on the local market. Whether for the oversea or the local market, it should be the aim of all producers to establish a reputation and then maintain that reputation. This can be achieved only by placing in the hands of the consumers guaranteed eggs in the best possible condition and style.

If the impending trial shipment of eggs is to prove a success the producer must in the first place send to the collecting-depots only eggs that are fresh in the strictest sense of the word, and clean and properly graded. It then lies with the depot-managers to carefully test, examine, and repack the eggs in standard cases so that they may be in the best possible condition for official grading. The next step is to place them on board ship as soon after grading as possible. Given these conditions, the rest lies with the experts in refrigeration.

Election of Board of Agriculture.—At a recent meeting of the Board of Agriculture a letter was received from the agricultural and pastoral societies in the Nelson, Marlborough, and Westland Districts suggesting that the regulations relating to the election of members of the Board be amended so as to permit of the election being conducted by post. It was decided to recommend the matter to the Government for favourable consideration.

APPLE FLESH-COLLAPSE OR BROWN-HEART.

CONTROL MEASURES FOR ORCHARD AND COOL STORE.

R. WATERS, Biological Laboratory, Wellington.

INTRODUCTION.

THE demand for the best-known means of controlling apple flesh-collapse requires at once that a definite stand shall be taken as to the cause of the disease. While, however, sufficient evidence is forthcoming to justify such a stand being taken for practical purposes, our knowledge of this subject must still be regarded as incomplete. The following authorities may briefly be quoted :—

(1.) Mr. A. H. Ashbolt, the present Agent-General for Tasmania in London, and Sir Henry Jones, experimenting at Hobart some years ago, propounded the theory that brown-heart was due to suffocation. (2.) The Department of Scientific and Industrial Research, in London and at Cambridge, reporting upon the damaged cargoes of Australian apples in 1922, stated that they thought they were "safe in concluding quite definitely that the cause of the damage to these shipments is lack of oxygen combined with a high percentage of carbon dioxide in the holds; in other words, the apples are suffocated." (3.) Dr. Charles Brooks, Pathologist to the United States Department of Agriculture, is reported as saying that he thinks the disease is largely due to the accumulation of gases given off by the apples. (4.) Professor McAlpine, Australian Commonwealth Investigator of Fruit-disease, says brown-heart is caused by lack of oxygen and excess of carbon dioxide. (5.) Drs. Ballard, Magness, and Hawkins, of the United States Department of Agriculture, say that internal browning (as they term this disease) appears to be brought about by certain conditions within the fruit itself. (6.) We in New Zealand have shown that no organism is to be found that would account for the disease, and, further, that apples submerged in water or confined in an airtight vessel eventually sustain an internal injury indistinguishable from flesh-collapse. In these experiments, moreover, it was noteworthy that in the absence of oxygen a greater or lesser portion of the flesh of the apple (Sturmers) was injured but not browned. Only after subsequent exposure to the air did such injured tissues discolour in a manner characteristic of flesh-collapse.

From the foregoing there appears a considerable concurrence of opinion as to the main cause of flesh-collapse. Despite this, however, it must not be forgotten that when a case of apples is subjected to a deficiency of oxygen and an excess of carbon dioxide all the apples in that case do not become uniformly injured by flesh-collapse as a rule. This suggests that there are differences in the susceptibility of individual apples, and this suggestion is borne out by the maturity experiments conducted by the New Zealand Department of Agriculture. In these experiments the riper Sturmers suffered more from flesh-collapse than did the greener ones. Apart, therefore, from the suffocation of the apples through a deficiency of oxygen, we must recognize

a difference in the ability of apples to cope with these circumstances. Furthermore, the matter of temperature would appear to have a bearing. Drs. Ballard, Magness, and Hawkins state definitely that internal browning develops to a far greater extent in fruit held at 32° F. than in that kept at 36° to 40°, and its occurrence to an extent sufficient to be important commercially can be largely prevented by storing the Pajaro Valley apples (Yellow Newtons) at 36° to 38°.

For practical purposes the factors contributing to flesh-collapse, so far as we know them, may be summarized as follows :—

(1.) Apples supplied with an insufficiency of oxygen in a short time are liable to suffer internal injury, not necessarily marked at once by the discoloration characteristic of flesh-collapse.

(2.) In "airtight" apple-stores such insufficiency of oxgyen is accompanied by an excess of carbon dioxide, for the apples convert the former into the latter in the process of respiration.

(3.) Subsequently, in the presence of a sufficiency of oxygen, the tissues where previously injured commence to discolour, producing the browned symptom characteristic of flesh-collapse.

(4.) Varieties, lines, and even individual apples in the same case vary considerably in their susceptibility to flesh-collapse, some exhibiting immunity under conditions that are most productive of the disease. One of the main causes, if not the main cause, of this susceptibility is overmaturity for the conditions with which the fruit has to contend in cool storage. There is, however, every reason for believing that certain improvements in cool-storage conditions will enable the fruit to be stored at a more advanced stage of maturity than would otherwise be possible.

(5.) Temperature has also been suggested as having a bearing upon the prevalence of flesh-collapse.

With this outlook it is now proposed to approach the question of apple-preservation from the orchard through the cool store to the market, referring, as the subject is proceeded with, to any knowledge that may be applied at any stage as a preventive of flesh-collapse.

ORCHARD CONDITIONS.

In a report made in November, 1920, I stated that the field conditions rendered satisfactory cool storage not impossible but more difficult than in certain past years. Locality, weather, cultivation, manurial treatment, age of trees, maturity of fruit, method of packing for storage, cases, and time elapsing between picking and delivery to cool store, all doubtless have to some extent a bearing upon the final power of the apple to stand up to the cool-storage conditions that are available to the orchardist at present.

Locality.

Ballard, Magness, and Hawkins state that internal browning is most prone to occur in Yellow Newtons from the floor of the lower Pajaro Valley, where conditions of low temperature and high humidity during the growing season are coupled with very fertile soil ; but that even in this valley there are certain seasons in which little browning

develops, and in seasons when it does develop there are certain trees the fruits of which show little browning, and even from those trees most of the fruit of which show bad browning certain apples will remain entirely sound in cool storage.

It can be said definitely that certain apples of the same variety and size, picked on the same days and by the same pickers from the same trees, and stored within twenty-four hours, have kept well in one cool store, while in another they have developed flesh-collapse abundantly. Moreover, the valley country that in 1921 we deemed in New Zealand to produce the most resistant fruit gave a considerable amount of flesh-collapse in 1922. Our evidence does not confirm the view of Ballard, Magness, and Hawkins; on the contrary, my report made in 1922 recorded that " the matter of locality would appear to be relatively insignificant concerning the cause of this disease." On the other hand, we have shown that overmaturity does contribute to the amount of damage from flesh-collapse. The results secured by these three investigators might therefore possibly be explained by the variation in the degree of maturity in the fruit under observation. I would certainly hold that, so far as New Zealand is concerned, locality in itself is a minor matter in connection with the development of flesh-collapse in cool stores.

Weather, Cultivation, Fertilizers, and Age of Trees.

While weather conditions may have some slight bearing upon the occurrence of flesh-collapse, there is actually no evidence to show that the nature of the weather ever made it appreciably more difficult to store the fruit. In fact, in seasons when the weather conditions were suspected we find fruit from the same trees keeping well in one cool store but developing flesh-collapse in another.

Cultivation is also held to play but a minor part. It would certainly help to neutralize any extreme weather conditions, but as a factor inducing or preventing flesh-collapse little more importance than this is ascribed to it.

Ballard, Magness, and Hawkins state as a result of their experiments with fertilizers: " In general it may be said that the results have been negative so far as causing or preventing browning through fertilizers is concerned."

It is often held that the fruit from young trees is more liable to flesh-collapse than that from older trees. New Zealand experiments show definitely that Sturmers from seven- and eight-year-old trees are capable of perfectly satisfactory cool storage. It is inconceivable that the abundance of flesh-collapse we have met with in the past three years developed because the injured fruit came from trees of less than eight years old.

Maturity.

Experiments instituted early in 1922 demonstrate clearly that apples cool-stored at different stages of maturity show marked differences in their susceptibility to flesh-collapse. There is no doubt that this aspect of the question has not received the attention it deserves. The Australasian Refrigerated Tonnage Committee drew attention to this fact in September, 1922. Certain investigators have published

their conclusions regarding this disease without mention of the maturity of the fruit under experiment. Certainly there are some difficulties in determining experimentally whether the development of flesh-collapse can be attributed to any extent to overmaturity. The first of these difficulties is to determine what constitutes any special stage of maturity, and the second is to select for experimentation a number of apples coinciding in respect to their stage of maturity. No precision can be ensured in this matter. The fact is that the judgment as to maturity is made mainly on appearance of colour, and that the seasonal conditions, the nature of the locality, the amount of the leafage of the trees, and other factors are liable to modify these appearances upon which maturity is judged.

The lack of precision in this matter is a real difficulty in the way of securing consistent results in experimentation; it has no doubt been responsible for several irregularities in the results of my maturity experiments last year. Despite this difficulty, it was absolutely necessary that some attempt should be made to determine the influence of maturity upon flesh-collapse, so vital is this question both to the apple-grower and the cool-store interest: The position of these two parties is as follows: The apple-grower, on the one hand, expects to pay for cool storage out of the increase in profits from selling out of season when prices are high; his aim is to unload when the prices are at their highest. Cool storage, on the other hand, has won a place for itself because it has made this possible. When, however, the fruit is at last marketed one line competes with another. The highest prices go for lines with those qualities that appeal to the customer. One of these qualities is colour, and colour increases with maturity, and the more advanced the maturity the more difficult is it to store the fruit successfully. The accompanying table gives some details of experiments showing the effects of maturity upon the development of flesh-collapse in cool store:—

TABLE I.—SHOWING THE AVERAGE PERCENTAGE OF STURMER APPLES AFFECTED BY FLESH-COLLAPSE IN COOL STORE, AMONG THE OVERMATURE, THE MATURE, AND THE LESS-MATURE FRUIT RESPECTIVELY, AT EACH EXAMINATION.

Date picked and stored.	Date examined.	Duration of Cool Storage.	Extent to which Overmature affected.				Extent to which Mature affected.				Extent to which Less Mature affected.			
			Very Bad.	Bad.	Slight	Total	Very Bad.	Bad.	Slight	Total	Very Bad.	Bad.	Slight	Total.
1922.	1922.	Mths.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Ber Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
29 April ..	29 Aug.	4·0	5	16	39	**60**	..	..	..	..	..	..	..	..
11 ,, ..	29 ,,	4·5	..	..	..	..	0	1	10	**11**	..	..	..	..
30 March	29 ,,	5·0	..	..	..	..	..	..	..	..	0	1	8	**9**
29 April ..	4 Oct.	5·0	3	13	52	**68**	..	..	..	..	..	..	..	..
11 ,, ..	4 ,,	5·5	..	..	..	..	0	2	19	**21**	..	..	..	..
30 March	4 ,,	6·0	..	..	..	..	..	..	..	..	0	1	9	**10**
29 April ..	3 Nov.	6·0	9	16	53	**78**	..	..	..	..	..	..	..	..
11 ,, ..	3 ,,	6·5	..	..	..	..	3	7	26	**36**	..	..	..	..
30 March	3 ,,	7·0	..	..	..	..	..	..	..	..	1	3	9	**13**

It will be seen that Sturmers were used in these experiments, and that an attempt was made to select three distinct stages of maturity, these being called "overmature," "mature," and "less mature"

respectively. All the fruit was practically of the same size—namely, $2\frac{3}{4}$ in. diameter—and was cool-stored within twenty-four hours of picking. The less-mature apples were picked and stored on 30th March, the mature apples on 11th April, and the overmature on 29th April. The overmature apples had thus been exposed to cool-storage conditions a month less than the less-mature fruit at the dates when they were examined. Despite this, it will be seen that they suffered most from flesh-collapse. The experiment was conducted in triplicate, three separate cool rooms being used (unfortunately, the overmature fruit was omitted in the third room). Moreover, in each cool room the experiment was duplicated. In recording the results fifty apples from each line were cut and examined for the presence of flesh-collapse only. Three such examinations were made at intervals of one month—firstly, on 29th August, when the fruit had been cool-stored for four to five months; secondly, on 4th October, after five or six months' storage; and, thirdly, on 3rd November, after six to seven months' storage.

One consistent feature of the experiment was the fact that the overmature fruit invariably showed a greater percentage of flesh-collapse than the mature or the less-mature fruit. In most cases there was twice as much of the disease found in the overmature fruit, the extent of the injury ranging from 38 up to 92 per cent. This is the most noteworthy feature of these experiments, indicating as it does that even under cool-storage conditions that favour the development of the disease much loss—probably 50 per cent. in some cases—can be averted by the selection of less-mature fruit for storage. Now, the reduction in the amount of flesh-collapse by picking the fruit in a greener state may be of immediate value in arresting the serious losses that some growers have sustained for two or three years past, but I fully recognize that alteration of the stage of maturity to suit the cool-storage conditions is not a desirable move if it is going to reduce the ultimate attractiveness and market value of the fruit. The selection of greener fruit is to be regarded as a temporary precautionary measure. There is no doubt whatever that cool storage will shortly be modified so as to enable the more attractive lines to be stored satisfactorily.

The stage of maturity, therefore, has a very direct bearing upon the percentage of flesh-collapse developed in cool storage, but better cool-storage conditions will enable the more mature lines to be stored satisfactorily. In the meantime the judgment of the condition required for storage presents no little difficulty to the grower. One who has suffered badly from flesh-collapse must select less-mature fruit, but not so green as to give rise to premature shrivelling.

Packing.

So far as packing for the cool store is concerned, there are several points that may be availed of as temporary precautionary measures. Anything that facilitates the escape of gases from the case into the chamber is of assistance. This will be better appreciated when the cool-storage conditions are considered. Close packing and the use of paper or wood-wool may be considered an advantage, or may even be essential in certain circumstances, but for the prevention of flesh-

collapse in uncertain cool-storage conditions they are to be avoided. For similar reasons liberal spaces between the boards of the cases are helpful.

Time elapsing between Picking and Delivery.

There appear to be several factors that may influence the results from delayed storage. If delayed delivery results in marked over-maturity, then one would expect a consequent increase in flesh-collapse under cool-storage conditions. On the other hand, the first four weeks are the most difficult in which to secure satisfactory conditions in the cool store, and delayed delivery may result in better storage conditions outside than would be obtained in the cool store, with a consequent increase in the longevity of the fruit. Under such circumstances I would view delayed storage as a good temporary measure, but would certainly say that the ultimate aim should be to bring the cool-store conditions at the commencement of the storage season to such a state of perfection that they shall be at least as good as any conditions obtainable outside.

COOL-STORE CONDITIONS.

The present circumstances call for definite working arrangements for the prevention of flesh-collapse, and I therefore here set out a definite plan—not expecting that it should necessarily be adopted in its entirety, but that it may form a basis for discussion for those with wide experience in the storage of apples.

Temperature-range.

I would suggest a slight alteration in the method of judging the temperature of apple cool stores. My proposal is that the discharge thermometer commonly used should be hung between the discharge-duct and the stack, midway between the ceiling and the floor, its purpose to be mainly to enable the engineer to avoid exceeding the minimum discharge temperature during the hours of running. In addition to this I suggest that a second thermometer be tightly sunk into a medium-sized apple in a case in, say, the third row from the discharge end, on a level with the discharge thermometer; its purpose would be to indicate the apple-flesh temperature at the discharge end, and enable the engineer to avoid exceeding the minimum apple-flesh temperature. A third thermometer is also suggested, to be situated at the suction end, and sunk tightly into an apple in a case midway between the floor and the ceiling, its purpose being to enable the engineer to avoid exceeding the maximum apple-flesh temperature. In large stores other thermometers may be required at various places in pairs—one in the air and the other sunk in apple-flesh; these will enable the circulation to be diverted as required by incoming fruit.

Another suggestion is that the minimum discharge temperature shall be 31° F., the minimum apple-flesh temperature at the discharge end 32°, and the maximum apple-flesh temperature at the suction end 36°. It will be seen that this system admits of fluctuation in the temperature of the chamber-atmosphere, provided that such fluctuation does not cause the apple-flesh to exceed its minimum and maximum temperatures. The use of an automatic recording thermometer at the discharge end is also strongly recommended.

The next point that requires special attention is the actual manipulation of the plant at the beginning of the storage season, in a manner that these temperatures may be secured, this being the time when flesh-collapse is most likely to be set up. The excellent work of the Department of Scientific and Industrial Research, of Cambridge, has afforded us definite information as to the effects of high temperatures at the commencement of cool storage. It shows that at 50° apples packed in an airtight hold are liable to be damaged by flesh-collapse after two or three days. Now, our apples will arrive at the cool store with a flesh-temperature between 50° and 60°, and the first problem is to reduce that temperature, for the lower the temperature of the apple-flesh the slower does it consume oxygen, and the less likelihood, then, is there of suffocation and flesh-collapse. If adequate ventilation could be provided apples could remain in a mean temperature of 50° for months (as is done when they are stored in an ordinary shed), or they might be exposed to a temperature of as low as 20° for several hours, without subsequently developing flesh-collapse. With this proviso, it is therefore not essential that the initial apple-flesh temperatures of 50° to 60° shall be reduced to 32° in two or three days, but it is nevertheless highly desirable to do so, for, as the temperature comes down, the risk of a deficiency of oxygen becomes less and less.

I would further suggest that cool rooms should be thoroughly cooled before the admission of the fruit, and the flesh-temperature of the apples reduced to about 40° by the end of the first twenty-four hours, and to 32° by the end of the next twenty-four hours. Where fruit is being received into a large cool room over a long period special attention will be required at those parts of the room where warm fruit has been stacked previously. At first, owing to there being very little fruit in a large store, or, later, owing to the addition of large quantities of warm fruit on the same day, or to the actual time occupied in the receipt and stacking of fruit, it may be difficult with some plants to secure the required drop in apple-flesh temperature in the required time without exceeding the minimum discharge temperature. When, for instance, fruit is being received it may not be possible to work the full twenty-four hours a day, and even if it were possible it is desirable in some cases to leave some time for ventilation and defrosting battery-pipes. In such cases it is advisable to place no more warm fruit in a cool room than can be satisfactorily treated. If, therefore, the introduction of warm fruit is carried on until it is seen to be interfering with the cooling programme that has been decided on, then it would be better to hold any excess of fruit over in the packing-shed until the next day, rather than risk the safety of the main bulk already in store.

The beginning of the storage season calls for much greater efficiency in the plant than does any other time, and it is advisable that the outfit be capable of securing the requisite drop in flesh-temperature working much less than twenty-four hours a day. If under the various awkward conditions that confront the engineer at the beginning of the storage season this reduction in apple-flesh temperature cannot be accomplished, then the question arises as to whether the fans should not be increased in size and rendered capable of at least two speeds—one being greater than the existing speed. By this means

the rate of circulation could be accelerated, and consequently the efficiency of the plant per hour increased, without exceeding the minimum discharge temperature. The efficiency of the plant will require to be greater than to barely bring down the flesh-temperature the required amount per shift. For instance, if it is desired to reduce the flesh 10° in the first shift, then the actual reduction might require to be 13°, so as to allow, say, 2° rise while the plant is not working and, say, 1° rise during ventilation.

When the temperatures have been stabilized at the commencement of the season there is another consideration of much importance. As pointed out by Mr. N. B. Brown, engineer to the Nelson Freezing Company, if the machinery is capable of performing the required amount of work in a comparatively short time—say, with eight to twelve hours working per day—a fluctuation in the temperature of the air of the chamber can be secured without materially affecting the flesh-temperature, and such fluctuation will assist in the diffusion and equalization of the chamber-atmosphere and the atmosphere within each case, and will avoid the formation of pockets where gases accumulate or where the effects of the cooling process are not proportionately felt. The best time to apply the power will be during the hottest period of the day —say, 9 a.m. to 5 p.m.; but the period of running at the commencement of the season will be uncertain, the intake of fruit and other factors necessitating somewhat irregular hours of running to obtain the required result in the apple-flesh.

The use of, say, 4 in. by 2 in. timbers on the floor and battens between cases—both running with the air-current—is, of course, highly advisable to assist in the cooling and ventilating processes. For the same reason a space between the ceiling and the top of the stack, and between the walls and the stack, particularly at the discharge and suction ends, is necessary. Floor-to-ceiling circulation will, of course, require slightly different stacking from end-to-end circulation.

Ventilation.

The higher the apple-flesh temperature the more frequent will the ventilation require to be, because the more oxygen will be used by the fruit. Again, the more fruit there is in a store the less air will there be, and the more frequent will the ventilation require to be. The Cambridge Department of Industrial and Scientific Research has supplied invaluable information as to ventilation requirements. Apples consume oxygen, and simultaneously produce carbon dioxide equal in amount to that of the oxygen they have consumed. The Cambridge investigators have ascertained that so long as the atmosphere contains 8 per cent. or more of oxygen and 12 per cent. or less of carbon dioxide there is, under all conditions, no danger of flesh-collapse. They have, moreover, utilized the instruments for automatically recording the carbon dioxide in flue-gas in connection with detecting the amount of carbon dioxide in apple cool stores.

Before a standard method of procedure can be laid down for a given store it appears to be necessary that some idea should be gained of the rate of accumulation of carbon dioxide in that store at the commencement of the season. No doubt such an idea could be secured

from a few analyses with a Lunge's nitrometer, and it is proposed that this should be done. As a liberal arrangement it is also proposed that the store be thoroughly ventilated each day till the minimum apple-flesh temperature is reached, when twice a week may be sufficient, or less, according to the carbon-dioxide content shown to be in the air. The fresh air will, of course, be brought in by the fan from outside, and cooled and dried over the battery before delivery into the cool store.

The best time of day to ventilate will depend upon the weather. Two points, however, can be borne in mind. Firstly, ventilation would be the most valuable shortly before the end of the day's running, so that when the power is shut off and the chamber-atmosphere becomes stationary there would not be a large quantity of carbon dioxide or other by-products to settle or collect in any one place—for in several stores the main damage from flesh-collapse has occurred in fruit near the floor. Secondly, there will generally be a smaller percentage of moisture in the atmosphere from about 9 o'clock on to about 3 or 4 o'clock in the afternoon; but as the atmosphere cools in the afternoon, and on through the night, the percentage of moisture in the atmosphere will increase even to the point of precipitating dew.

Humidity.

It has not been suggested that humidity in itself is connected with flesh-collapse; nevertheless, it is quite certain that a little more attention to this factor will make for more favourable conditions to apples in cool store. For example, the average natural relative humidity at Nelson from May to September is 82, while cool stores are more often found to be at or close to saturation-point, or 100. Outside, with a relative humidity of 82 and a mean temperature of 48°, apples will keep without shrivelling in an ordinary shed till the end of August. With an apple-flesh temperature of 32°, they would keep longer in a relative humidity of 82 without shrivelling. At a relative humidity of 100, however, there is little chance of the apple disposing of any water, and any slight drop of temperature would result in the precipitation of moisture on any cold surface, and a consequent development of mould.

Now, shrivelling is not dependent entirely upon temperature and humidity. The apple itself as it becomes mature develops certain mechanism for the conservation of its water content. As, however, it is shown that too advanced maturity favours flesh-collapse, and there may consequently be a tendency for some growers to select fruit too much on the immature side, it would be wise to aim for a humidity a little above 82. I therefore propose a relative humidity range of 90 to 95, to be maintained during the hours of running. The use of the wet- and dry-bulb thermometers will show whether or not this is being accomplished. The collection of moisture from the atmosphere may be increased by increasing the rate of circulation, which will enable the battery-pipes to be run at a lower temperature without reducing the temperature of the discharge. This increase in the cooling-power of the plant per hour will result in a reduction of the number of running-hours per day.

In maintaining the requisite humidity it is, of course, essential in a dry system that the battery-pipes should be kept defrosted, and in a brine system that the requisite specific gravity of the brine should be maintained.

I would here acknowledge my indebtedness to the engineer of the Nelson Freezing-works, Mr. N. B. Brown, whose willing co-operation and advice have greatly assisted in this investigation.

NEW LIMESTONES FOR AGRICULTURAL USE.

NOTES ON THE YEAR'S SAMPLES.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THE interest which farmers and others engaged in primary production continue to manifest in lime deposits natural to each district is shown by the increasing number of samples which are yearly received for chemical analysis.

A promising feature of the results of such inquiries is the comparatively large number of deposits of soft calcareous matter which are coming to light. The use of such deposits in liming the land, thereby avoiding the necessity for grinding and possibly even bagging the material, has been from time to time advocated by the Chemistry Section, and has proved useful in some districts. What is aimed at is that where a farmer can utilize a soft deposit from his own or a local source he should do so, thereby relieving the State from the free carriage of lime over the railways and enabling the power which would thus be used to be employed in other directions.

The following is a selected list of the more useful limestones received during the past official year, the laboratory number being given as a key in each case:—

P 558 was a sample from a deposit found in the Mangamuka Gorge Road, Rawene, Hokianga. The deposit is small, but would be of considerable value, the sender thinks, when the road is completed. The deposit is on the Mangamuka River, just south of Block II, Section 7, Mangamuka. This is an excellent specimen of soft limestone, and, as it contains 93 per cent. carbonate of lime, if the deposit is similar to the specimen sent it should be of great value to lands requiring carbonate of lime.

P 624: This is a calcareous sinter containing 93 per cent. carbonate of lime, from the property of J. J. Ogle, Rangiahua, Hokianga. If there is much of this material available it would prove a valuable deposit. Unfortunately, these sinter deposits are frequently of small extent and soon worked out.

P 364–9, 85–8, and 126: These are a series of limestones forwarded from Oue, in the Hokianga district. They are usually weathered limestones with veins of calcite running through them. The samples

were small, and on account of their uneven character may not be strictly representative of the bulk of the deposit from which they are gathered, but they show that a suitable agricultural limestone could be obtained in that locality. The samples contained from 70 to 84 per cent. carbonate of lime.

P 525–7 are three samples of comminuted sea-shells classified as fine shelly grits, the finer ones containing 88 to 92 per cent. and the coarser one 85 per cent. of calcium carbonate. They are interesting in revealing an unusual source of carbonate of lime for agricultural purposes in the far North at Taumarere, in the Bay of Islands district. The finer samples would certainly be efficaceous as a dressing for soils requiring carbonate of lime.

P 398 is a sample of crystalline limestone from Dargaville, containing 96 per cent. carbonate of lime. It would make when ground to a powder an excellent agricultural limestone, and would also be suitable for "burning" into a quicklime.

P 363 is a hard limestone of the usual Whangarei type, and contains 88 per cent. carbonate of lime. P 130–4 are from Kamo, Whangarei, and contain from 75 to 85 per cent. carbonate of lime. Compared with the usual run of stones from North Auckland, they are distinctly good.

P 47 is a useful calcareous marl from Maungaturoto, Otamatea County, containing 72 per cent. carbonate of lime. It could be used for dressing lands without previous grinding, as it would readily disintegrate in the soil. P 596 is a similar stone to the last, from Paparoa, in the same county. It also contains 72 per cent. carbonate of lime.

P 28 is a marble-like hard limestone from Aria, Waitomo, and contains 98·5 per cent. carbonate of lime, suitable either for "burning" or grinding into a ground limestone.

P 372 is a calcareous sinter from Havelock North, containing 91 per cent. carbonate of lime.

P 342–3 are calcareous sinters forwarded from Napier (locality not stated), containing 93 per cent. carbonate of lime. They are soft and easily reduced to a powder, and would be eminently suitable for converting into ground carbonate of lime for agricultural use.

P 40–1 are calcareous sinters from Matainga Station, near Dannevirke. They contain 93 per cent. carbonate of lime. The remarks on P 342–3 also apply to these.

P 607 is a fairly coarse shelly grit deposit at Matamau, Dannevirke, containing 84 per cent. carbonate of lime. Without further grinding it would form a valuable source of carbonate of lime for agricultural purposes. Probably a preliminary screening to separate the coarser particles would increase its efficiency. The possibilities of this deposit are being further investigated.

P 515 is a calcareous sinter containing 87 per cent. carbonate of lime, from Te Pa, near Dannevirke, and would be an excellent source of agricultural carbonate of lime. It would weather down quickly if applied in an uncrushed condition.

P 54, from Te Rehunga, Dannevirke, is a very friable white limestone containing 96 per cent. carbonate of lime, and would require very little power to reduce it to a state suitable for application to the land. This is one of the purest and most easily ground limestones that have been submitted for examination.

P 62 is a soft granular deposit from Wanstead, Hawke's Bay, containing 91 per cent. carbonate of lime. It could be applied to the land as dug from the deposit, without further reduction. With very little treatment this material would make an excellent commercial ground limestone for agricultural use. P 164 is a sample from another deposit on the same property at Wanstead. This is a similar sample to P 62, but is slightly less pure.

P 334 is a sample of a deposit of soft carbonate of lime from Kaipara. It contains 72 per cent. carbonate of lime, and could be applied to the land as dug from the deposit. For the North Auckland west-coast district, where a high-grade limestone is somewhat difficult to obtain, this should be a particularly useful deposit.

P 397, from Moerangi, Kawhia, is a hard crystalline stone containing 86 per cent. carbonate of lime. If the specimen is a representative one the stone is adapted to the production of "burnt" lime, as well as for grinding for agricultural use.

P 10, from Charleston, Westport, is a limestone of good quality, containing 95 per cent. carbonate of lime. It would produce a ground limestone of the first grade, and could be calcined to a quicklime of good quality.

P 580 is a sample of dark reddish-brown limestone from Taylor's Pass Road, Wairau Valley, Marlborough, containing 91 per cent. carbonate of lime. This is a hard, crystalline stone containing small amounts of iron and manganese.

P 214, from Mount Lud, Kaikoura, is a soft chalk-like deposit containing 96 per cent. carbonate of lime. If available in quantity this would be a valuable source of carbonate of lime for agricultural purposes. In addition to its agricultural value this material is worth testing in the manufacture of putty and for similar purposes. This sample contains the remains of similar organisms to those found in true chalk.

P 567 is a white chalky sample from Waikari, North Canterbury. It contains 73 per cent. carbonate of lime.

P 7, from Hampden, Otago, is a hard crystalline limestone containing 98·5 per cent. carbonate of lime.

P 191 is a soft carbonate of lime from Otekaieke, Oamaru, which would form an excellent dressing for soils needing carbonate of lime. It contains 82 per cent. carbonate of lime.

P 74 is a hard white crystalline stone of very high grade, from Milburn, Otago. It is exceptionally well suited to calcining to quicklime, or would make an agricultural ground limestone of the highest grade. It contains 98·5 per cent. carbonate of lime.

Breeding of Geese.—A correspondent asks how many geese may be mated to each gander. In order to secure the best results not more than two or three geese should be kept with one gander.

MANURIAL TRIALS WITH WHEAT AT CARTERTON.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Wellington.

FOR the past two seasons the Department has conducted a manurial trial with wheat on the farm of Mr. M. C. Jansen, at Carterton, in the Wairarapa district. The ground selected for experiment was a fairly heavy loam having at a depth of from 9 in. to 12 in. an ironstone subsoil. The land was worked out of the lea, being skim-ploughed in June and cross-ploughed late in July, 1922. Lime in the ground carbonate form was applied at the rate of 1½ tons per acre in August on part of the area (plots 6 to 9). The wheat was sown early in September, the variety being Solid-straw Tuscan. Manure, where applied, was sown at the same time as the wheat, from the manure-box of the drill.

GENERAL VIEW OF THE WHEAT CROP ON MR. JANSEN'S FARM: SECOND SEASON.

During the growing-period of the first season there were no marked differences to be seen among the various plots. During the second season, however, when the same variety of wheat was sown, but neither lime nor manure again applied, marked differences were perceptible, as the following notes made in January, 1923, on the occasion of a farmers' field-day, will show :—

Plot 1, control: On this plot the crop is fair, except on one corner where the proximity to some gum-trees has accounted for the total absence of growth.

Plot 2, Nauru ground rock phosphate: The wheat on this plot has headed far better than has that on No. 1, where neither lime nor manure has been used. A much larger percentage of this wheat shows signs of rapidly approaching maturity.

Plot 3, Nauru superphosphate: The growth of straw on this area has been prolific, but the wheat is less advanced.

Plot 4, Nauru ground rock mixed with superphosphate: From all appearances this is the best plot in the paddock. It is maturing evenly, has stooled excellently, is full in the head, and at the same time fairly fine in the straw.

Plot 5, control: This untreated plot was green as compared with the whiteness of the adjoining plot No. 4.

Plot 6, limed control: The wheat here was more advanced than on No. 5, but less so than on the manured plots.

Plot 7, Nauru ground rock used after lime: The result on this plot, to all present appearances, is much better than that on No. 2, where rock phosphate was used alone.

Plot 8, superphosphate used after lime: This plot appears to be the next in quality to that on which the mixture of rock phosphate and superphosphate has been used.

Plot 9, limed control: This plot has a gentle slope, and the surface is much nearer to the ironstone than on other plots. Last year there were many patches upon which wheat did not grow at all. This year the whole plot is well covered, and the wheat crop is considerably better. This indicates that the lime is beginning to show its effects.

The yields obtained for the two seasons were as follows:—

Plot.	Treatment.	Area.	Season 1921–22: Yield per Acre.	Season 1922–23: Yield per Acre.
		Acre.	Bushels.	Bushels.
1	Control	1	29·4	31·2
2	Nauru ground rock, 1½ cwt. ..	1	36·1	40·3
3	Nauru superphosphate, 1½ cwt. ..	1	36·9	41·5
4	Nauru rock, 1 cwt., and Nauru super ½ cwt.	1	42·4	45·6
5	Control	½	37·6	40·9
6	Limed control, 1½ tons	½	38·9	41·9
7	Nauru rock, 1½ cwt., and lime, 1½ tons	1	39·5	43·3
8	Nauru super, 1½ cwt., and lime, 1½ tons	1	37·1	42·1
9	Limed control, 1½ tons	1	25·4	34·4

As already indicated, the soil of plot 1, being in close proximity to a group of gum-trees, is poorer than that of the adjoining plots. In the case of plot 9 the ironstone comes nearer to the surface than it does on the other plots, owing to the fact that the surface soil slopes steeply away. The soil here, moreover, is wetter and sourer than is that of the adjoining plots. For these reasons it is evident that plots 1 and 9 cannot justly be compared with other plots in the paddock. The soil on all the other plots is sufficiently uniform to allow of comparisons being made. It must be noted, however, that in the case of plot 9 (the limed control) the yield this season (34·4 bushels per acre) as compared with that of last season (25·4 bushels per acre) shows an advantage of slightly over 26 per cent. This is probably due to the fact that the lime is beginning to act in a place where its need was so manifest.

Apart from the difference secured in the latter instance, the results obtained from liming in this experiment are very inconclusive. The results obtained from Nauru rock and superphosphate do not show high margins over and above the untreated plot in the centre of the paddock. The most successful result is that obtained from the use of a mixture of 1 cwt. Nauru rock phosphate and ½ cwt. Nauru superphosphate.

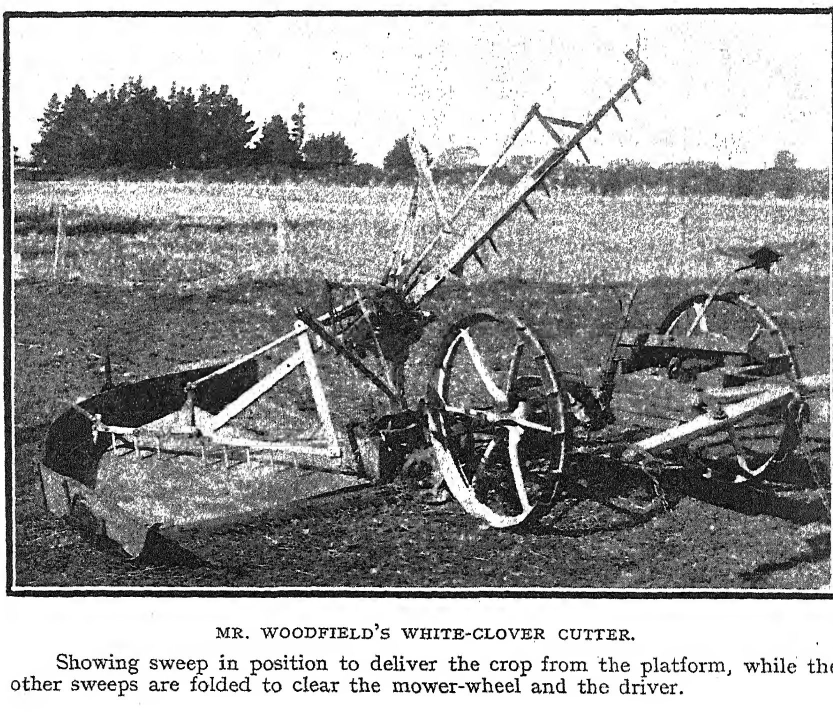
It will also be noted that in every case the yields have been higher this year, when no manure was applied, than they were last season, when the land was ploughed out of the lea and both manure and lime were applied. It is evident that in the 1921–22 season the ground was somewhat too strong to admit of successful wheat-growing.

Trials regarding the effect of Nauru phosphates on wheat have also been conducted on the farm of Mr. D. Smith, Masterton.

AN IMPROVED WHITE-CLOVER CUTTER.

THE accompanying photograph illustrates how Mr. C. Woodfield, of Horrelville, Canterbury, has contrived, with a very large measure of success, to adapt a mowing-machine for harvesting white clover.

The ordinary side-delivery machine does not cut close enough to the ground to catch all the heads, while the speed of the knife is too slow to cope with the heavy swath of green undergrowth. Mr. Woodfield's aim was to combine the close-cutting virtue of the grass-mower with the collecting and windrowing mechanism of the side delivery. To gain these points he inverted an ordinary mowing-machine, and with the aid of a special casting brought the knife behind instead of in front of the mower-wheel. A specially constructed platform mounted



MR. WOODFIELD'S WHITE-CLOVER CUTTER.

Showing sweep in position to deliver the crop from the platform, while the other sweeps are folded to clear the mower-wheel and the driver.

upon three small wheels is attached to the knife-bar, and sweeps to collect and deliver the clover are attached to the centre-mounting on this platform and driven by means of a chain direct from the main axle of the mower. A seat is fitted to one side, giving a view of both the horses and the mower, and by means of a special folding-device the sweeps are raised to clear both the mower-wheel and the driver as they pass. The platform is fitted with a box covered with perforated zinc to catch the threshed seed which invariably falls on the journey from the knife to the windrow, and it is contended that the expenses of harvesting are often collected in this box. A wire connects the trip to a pedal on the footboard, thus enabling the operator to trip the machine when required and so sweep the cut clover into rows behind the mower.

The photograph was taken when the machine had just finished its fourth season, having cut a total of 250 acres. The marks of hard wear are apparent in many places, while the toothless condition of some of the sweeps bears testimony of work under many adverse conditions.

—*F. E. Ward, Instructor in Agriculture, Christchurch.*

THE KING AND AGRICULTURE.

DURING the recent visit of the King and Queen to Rome they visited the International Institute of Agriculture. In replying to an address of welcome by the President of the Institute, the following interesting remarks were made by His Majesty :—

"The agricultural industry is of vital and universal importance, for it provides not only the actual necessities of life, but a firm foundation of social and political stability, while ensuring to a thrifty and industrious population a life under the healthiest of natural conditions. Hence the welfare and prosperity of the agricultural community is a matter of deep concern to the Government and people of every country. I take a personal and active interest in the fortunes and misfortunes of the industry not only in my own country and in the British dominions, but throughout the world. I am fully aware that, in addition to the uncertainties at all times inherent in agriculture, the industry to-day has to combat special difficulties owing to the severe fall in prices resulting from the Great War upheaval. My sympathy goes out to my fellow-agriculturists in their trials and anxieties; but I do not despair, believing that their traditional patience, courage, and enterprise will again carry them triumphantly through this present crisis. After the ravages of war the way to peace and prosperity is uphill and devious, and perhaps the best and most direct path is to be found along the lines of international co-operation, so admirably followed during the past eighteen years by the International Institute of Agriculture. One of the main functions of the Institute is to supply farmers in all countries with the latest information, practical as well as that based upon scientific research. Year by year the necessity for such an organization is more generally recognized throughout the British Empire, and the adoption by the Governments and the agriculturists of these up-to-date methods augurs well for the industry's future. Doubtless the same spirit is manifesting itself in this beautiful land of Italy as elsewhere. In these and other directions the achievements of the International Institute of Agriculture must always be of special value, and the Queen and I are happy to have the opportunity of inspecting its work. I shall always watch with interest the progress of the Institute, confident that, favoured by the generous support which it has invariably received from His Majesty the King of Italy, and with the hearty co-operation of the adhering States, it will continue to render great services to the most essential and ancient of all industries."

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING FACTORY AVERAGES FOR 1922–23.

W. M. SINGLETON, Director of the Dairy Division.

FROM time to time the Dairy Division receives requests from dairy company secretaries, factory-managers, and others interested for the season's average grade of the factory with which they are connected. Credit is due to those dairy companies which have exported produce attaining a high average grade for the season. It is also recognized that other companies are endeavouring to improve the quality of their output, and in such cases the chance of having their names included in a published list will provide some additional stimulus. The average grades for 1922–23, tabulated below, represent very meritorious work, and the New Zealand dairy industry is fortunate in being in a position to show such a list of factories with averages of 92 points or more for butter and 91 points or more for cheese.

BUTTER-FACTORIES WITH AN AVERAGE GRADE OF 92 POINTS AND OVER FOR YEAR ENDED 31ST MARCH, 1923.

Name of Company.	Registered No.	Brand.	Average Grade.
Auckland Grading-station.			
			Points.
Kaitaia	1298	Kaitaia	93·95
Piopio	603	Piopio	93·89
Kaitieke	1119	Kaitieke	93·74
Waipu	1248	Waipu	93·64
Cambridge	1239	Cambridge	93·52
New Zealand (Frankton Junction No. 1)	1510	Anchor, &c.	93·50
Whangarei	1720	Kauri	93·50
Maungaturoto	1407	Maungaturoto	93·48
Waitanguru	1154	Golden Gem	93·45
Oruru-Fairburn	1337	Fairy	93·42
Whangaroa	658	Whangaroa	93·41
Kaipara	794	Poplar, &c.	93·21
Hikurangi	303	Hikurangi	93·09
Northern Wairoa	1358	Northern Wairoa, &c.	92·80
Ruawai	66	Ruawai	92·77
Aria	1734	Aria	92·75
Mercury Bay	485	Mercury Bay	92·72
New Zealand (Frankton Junction No. 2)	1880	Anchor, &c.	92·69
New Zealand (Ngaruawahia)	22	Anchor, &c.	92·58
Maungatapere	1710	Moana	92·54
New Zealand (Waiuku)	111	Anchor, &c.	92·53
New Zealand (Waihou)	1458	Anchor, &c.	92·51
Bay of Plenty	1399	Bay of Plenty	92·51
New Zealand (Ngatea)	291	Anchor, &c.	92·47
Hokianga	1843	Hokianga	92·47
New Zealand (Pukekohe)	109	Anchor, &c.	92·36
Waitemata	332	Waitemata	92·33

BUTTER-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
Auckland—continued.			
			Points.
New Zealand (Tuakau)	1320	Anchor, &c.	92·27
Kaitieke (Matiere)	1698	Suprema	92·26
Amburys	392	Butterfly	92·07
New Zealand (Otorohanga)	185	Anchor, &c.	92·03
New Plymouth.			
Maketawa	342	M.D.C.	95·07
Tarurutangi	728	Champion	94·57
Bell Block	488	Bell Block	94·52
Midhirst	110	Rugby	94·35
Mangorei	345	Mangorei	94·03
Mangorei	345	Milklads	93·93
Omata	82	Lily	93·46
Lepperton	49	Lepperton	93·31
North Taranaki	723	Flax	92·95
Tikorangi	102	Shield	92·79
Stratford	68	Good Luck; Three Star	92·62
Eltham	31	Eltham	92·58
Waitara	726	Waitara	92·41
Ngaere	25	Triumph	92·18
Tariki	1818	Tariki	92·13
Kaponga	732	Kaponga	92·10
Patea.			
Mells	764	Mells	94·07
Manutahi	495	Manutahi	93·68
Kakaramea	630	Penguin	93·02
Hawera	346	Federation	92·34
Pihama	627	Pihama	92·30
Alton	1890	Alton	92·04
Riverdale	106	Trident	92·02
Meremere	316	Meremere	92·00
Wanganui.			
Cheltenham	3	Pakeha	93·45
Wangaehu	1326	Wangaehu	92·43
Rangitikei	1360	Rangitikei	92·33
Wellington.			
Levin	910	Lake	94·68
United	1220	Whariti	94·10
Rata	938	Rata, &c.	94·07
Riverbank	985	Riverbank	93·91
Taihape	1188	Tikapu	93·83
Shannon	1489	Shannon	93·78
Mauriceville	14	Mauriceville	93·65
Awahuri	664	Red Rose	93·48
Raetihi	717	Raetihi	93·47
Cheltenham	3	Pakeha	93·22
Featherston	360	Featherston	93·16
Manakau	815	Manakau	93·11
Murchison	1888	Airship	93·05
Karamea	1570	Karamea	93·02
Rangitikei	1360	Rangitikei	93·02
Heretaunga	1230	Heretaunga	92·97
Masterton	1307	Masterton	92·95
Kaikoura	302	Kai	92·88

BUTTER-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
		Wellington—continued.	
			Points.
Rangiwahia	750	Quail	92·86
Konini	1203	Konini	92·75
Waiaruhe	268	Arrow	92·75
Wellington City Municipal Milk	202	Rahui	92·64
Apiti	414	Apiti	92·62
Golden Bay	146	Sovereign	92·62
Pahiatua	140	Scarborough	92·51
Tamaki	1463	Chimes	92·39
Norsewood	600	Norsewood	92·24
Kairanga	1768	Longburn	92·15
Rongotea	8	Rongotea	92·12
Otaki	1236	Otaki	92·06
		Lyttelton.	
Akaroa	1579	Akaroa	93·56
Kaikoura	302	Kaikoura	93·34
Sefton	28	Sefton	93·19
Kiwi	299	K.D.C.	93·10
Tai Tapu	175	Tai Tapu	92·93
Canterbury Central	55	Fern-leaf	92·54
Caroline	236	Caroline	92·19
		Dunedin.	
Waitaki	812	Waitaki	94·37
Taieri and Peninsula	54	Peninsula	92·78

CHEESE-FACTORIES WITH AN AVERAGE GRADE OF 91 POINTS AND OVER FOR YEAR ENDED 31ST MARCH, 1923.

Name of Company.	Registered No.	Brand.	Average Grade.
		Auckland Grading-station.	
			Points.
Opouriao	1169	Opouriao	92·77
Horsham Downs	1089	Horsham Downs ..	92·31
New Zealand (Akaaka) ..	121	Anchor, &c.	92·15
Cambridge (Leamington) ..	126	Leamington	92·11
Cambridge (Monavale) ..	127	Monavale	91·75
New Zealand (Orini)	115	Anchor, &c.	91·64
New Zealand (Gordonton) ..	186	Anchor, &c.	91·57
Bruntwood	1534	Bruntwood	91·49
Kakepuku	83	Kakepuku	91·42
New Zealand (Okoroire) ..	189	Anchor, &c.	91·40
Tatua	34	Tatua	91·34
New Zealand (Rukuhia) ..	114	Anchor, &c.	91·29
New Zealand (Matatoki) ..	177	Anchor, &c.	91·23
Cambridge (Victoria Road) ..	124	Victoria Road ..	91·19
New Zealand (Manawaru) ..	77	Anchor, &c.	91·13
Waimana	1817	Waimana	91·07

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
		Moturoa.	Points.
Tariki	1700	Tariki	92·96
North Taranaki (Waipapa)	212	Flax	92·95
Pembroke	234	Pembroke	92·58
North Taranaki	723	Flax	92·17
Okato (Puniho)	48	Puniho	92·15
Kaimata	992	Oaks and Ash	92·12
Kaponga	1694	Kaponga	92·12
Tuna	209	Tuna	92·01
Bell Block	488	Bell Block	91·96
Tariki (Rugby Road)	216	Miro	91·93
Okato	85	Okato	91·76
Patua	73	Patua	91·64
Kaponga (Rowan)	1696	Rowan	91·64
Oaonui	491	Gem	91·63
Okato (Leith)	57	Leith	91·61
Royal Oak	693	Royal Oak	91·43
Frankley Road	201	Frankley Road	91·40
Kaponga (Riverlea)	1695	Riverlea	91·39
Waitoitoi	20	Waitoitoi	91·14
Warea	87	Warea	91·14
Cape Egmont	632	Cape Egmont	91·06
Eltham (Jerseydale)	1031	Jerseydale	91·03
		Patea.	
Pihama	627	Pihama	92·48
Pihama (Skeet Road)	1111	Pihama	92·45
Mangatoki	136	Mangatoki	92·40
Mangatoki (Matapu)	1087	Mangatoki	92·35
Kaupokonui	633	Kaupokonui	92·30
Alton	1890	Alton	92·18
T. L. Joll (Okaiawa)	1727	Maori Chief	92·13
Kaupokonui (Katua)	1733	Katua	91·94
Kakaramea	630	Penguin	91·94
Mangatoki (Kaponga)	256	Mangatoki	91·64
Riverdale	106	Trident	91·63
Kaupokonui (Oeo)	1132	Oeo	91·54
Pihama (Waiteika Road)	1112	Pihama	91·47
Kaupokonui (Kapuni)	1629	Kapuni	91·35
Kohi	923	Kohi	91·24
Kaupokonui (Sutherland)	176	Sutherland	91·21
Kaupokonui (Skeet)	174	Skeet	91·02
Waverley	1834	Oturi	91·00
		Wanganui.	
Rapanui	1714	Southern Grove	91·03
		Wellington.	
Te Horo	134	The Allies	93·51
Kuku	905	Ohau	93·43
Norsewood (Ngamoko)	196	Norsewood	92·75
Ballance	1	Ballance	92·74
Nireaha	335	Nireaha	92·54
Hukanui	27	Hukanui	92·49
Norsewood (Makotuku)	135	Norsewood	92·33
Norsewood	1758	Norsewood	92·24
Maharahara	984	Maharahara	92·04

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
		Wellington—continued.	
			Points.
Tamaki	58	Big Ben	91·90
Marima	195	Marima	91·88
Kairanga	182	Kairanga	91·78
Kiritaki	1521	Premier	91·73
Mangaroa	252	Onward	91·57
Glen Oroua	906	Glen Oroua	91·45
Tamaki	1463	Bell	91·39
Manakau	815	Black Swan	91·33
Rongokokako	1280	Rongo	91·19
Kokotau	809	Kokotau	91·02
		Lyttelton.	
Little Akaloa	32	Little Akaloa	92·93
Milford	267	Milford	92·87
Temuka	207	Ohape	92·79
Staveley	1719	Staveley	92·17
Wairewa	471	Wairewa	91·98
Barry's Bay	401	Onawe	91·59
O'Kain's Bay	239	Milford ; O'Kain's Bay	91·08
		Dunedin.	
Omimi	74	Omimi	92·45
Milton	1030	Milton	91·92
Momona	1010	Allanton	91·65
Mosgiel	161	Mosgiel	91·55
Stirling	292	Stirling	91·55
Paretai	271	Paretai	91·45
		Bluff.	
Waianiwa	1171	Waianiwa	93·13
Tuturau	132	Tuturau	92·92
Edendale	36	Edendale	92·86
Brydone	1821	Brydone	92·75
Island	72	Island	92·55
Wright's Bush	206	Wright's Bush	92·48
Thornbury	1581	Thornbury	92·39
Boggy Burn	703	Boggy Burn	92·23
Wyndham	59	Wyndham	92·19
Rimu	1155	Rimu	92·19
Mataura	38	Mataura	92·15
Seaward Downs	702	Seaward Downs	92·10
Tisbury	701	Tisbury	91·99
Menzies Ferry	623	Menzies Ferry	91·96
Switzers	802	Switzers	91·96
Pukerau	480	Pukerau	91·91
Whiterig	798	Whiterig	91·89
Kennington	205	Kennington	91·85
Woodlands	1485	Woodlands	91·81
Pine Bush	543	Pine Bush	91·78
Otautau	1610	Otautau	91·71
Aparima	188	Aparima	91·68
Freshford	1224	Freshford	91·60
Morton Mains	1604	Morton Mains	91·54
Lochiel	659	Lochiel	91·03

SEASONAL NOTES.

THE FARM.

CULTIVATION.

With the arrival of August the preparation of land for spring crops must be pushed along as conditions of soil and weather will allow. For root crops such as carrots and mangolds the ploughing should be as deep as the nature of the land permits, provided always that the sod can be properly turned under. Virgin land, such as newly stumped areas, intended for swedes or turnips should also be ploughed as early as possible. Early ploughing allows the turned-under material time to rot and form a union with the subsoil, which ensures a good supply of moisture during the hot summer months by capillary attraction. For wheat the seed-bed should be worked deeply. The cultivator does better than the disk, as it works the fine soil down and brings the clods to the surface. These afford shelter for the young plants, and are later broken down by the roller.

CEREAL CROPS.

Generally speaking, the end of August is quite early enough for sowing spring wheat. In order to make up for the lesser amount of tillering, a heavier seeding than with autumn-sown is required, about 2½ bushels per acre being the correct thing. Superphosphate, from 1 cwt. to 2 cwt. per acre, is a suitable manure. Spring-sown cereals in general are more susceptible to disease than those sown in autumn, and all seed-wheat should be dressed for smut before sowing. The best dressing is the ordinary 40-per-cent. formalin as supplied by chemists, at the rate of 1 pint to 40 gallons of water. Spread the wheat out on a floor and sprinkle with spray-pump or watering-can until all the grain is wet, using a shovel to do the necessary turning. The grain should be left on the floor all night and bagged in the morning. Any wheat which may happen to be left over when sowing is completed can be used for fowl-feed, there being no danger from poisoning.

The standard wheats for South Island grain-growing districts need hardly be mentioned here. Among the best varieties for North Island conditions are Major, Marquis, and John Brown. During the last two seasons in several districts Major has beaten all other varieties for yield, and has the great advantage that the straw is very strong and will stand up on most lands. Besides this, it is a quick-maturing wheat, and may be sown as late as the first week in October.

Oats and early barley also may be sown in August. Cape or (if obtainable) Black Skinless barley can be put in for spring feed.

Where it is intended to carry on an autumn-sown cereal crop for grain, chaff, or hay the final feeding should in most cases be done by the end of August, the exceptions being very strong land where there is a danger of the crop growing too much straw and lodging. In such situations feeding-off may often be profitably carried on until the end of September. After the final feeding the field should be given one or two strokes of the tine harrows. This will open the land and greatly hasten subsequent growth. If the crop has not been previously manured and appears somewhat thin or weak 1 cwt. of superphosphate per acre, applied before or during the harrowing, will greatly benefit it, and often means the difference between a profitable crop and a failure.

SPECIAL CROPS FOR HAY OR ENSILAGE.

In dry situations these may be sown towards the end of August, but generally September is early enough. Mixtures of oats and tares, oats and peas, and wheat and tares or peas are the most suitable; but where wheat is used instead of oats the tares seem to do better. As a general rule the sowing is at the rate of 2 bushels of the cereal to one of tares or peas. Golden tares are the best for spring sowing, but the ordinary grey does quite well. Grey Partridge or Early Minto are good varieties of peas. Suitable manures are basic super, super, or mixtures of half super and half Nauru phosphate or basic slag, 1 cwt. to 3 cwt.

per acre according to the quality of the land. Except in the case of very light land, manures containing nitrogen are not recommended.

TOP-DRESSING OF PASTURES.

This should have been already completed, but if there has been delay the work may still be carried out. When quick results are desired the top-dressing should consist of superphosphate, basic super, or lime and super. Where there is plenty of moisture basic slag may still be applied with fairly satisfactory results, but if the conditions are dry, dependence should be placed on one of the first two manures mentioned. On most dairy farms hay and roots will still be fed out and stock-droppings accumulating; it will therefore be necessary to keep the tripod or chain harrow going to keep these distributed.

FEEDING OF ROOTS AND GREEN CROPS.

Swede crops will now be getting past their best, and where mangolds have been provided a start will be made to feed them. For ewes, either before or after lambing, they are excellent. The ewes may be turned on to breaks where the roots have been previously pulled or harrowed out, but it is better for the ewes, and the mangolds will go a great deal further, if they are carted out on to a nice clean grass-paddock. Under these conditions there is little danger of the ewe eating too much. There are not many forages that ewes will milk better on than properly ripened mangolds.

With dairy cows the feeding of mangolds should be fairly light for the first few days. For cows in profit one can start with 20 lb. per cow per day, increasing the allowance to 50 lb. or 60 lb. at the end of a week. Cows that have not yet come into profit should not receive more than 40 lb. per day. Always provide a liberal supply of hay, and feed this before the roots.

In many cases cows as they come into profit will be given from about half an hour daily on green oats or other cereal crops. Care should be taken to see that they are not on too long for the first few days, particularly if the weather is wet and cold; if allowed to eat too much under these conditions there is considerable danger of redwater. With judicious feeding and plenty of good hay the danger is reduced to a minimum.

—*Fields Division.*

SOME LAMBING HINTS.

It is good practice to have two paddocks shut up for a while prior to lambing-time. Into one of these can be turned the ewes with one lamb, and into the other the ewes with twins. The latter should have the paddock with the better growth of feed, if there is any difference.

In many cases, more especially with flocks of up to, say, 2,000 ewes, it is very convenient to have a small yard with a few lambing or mothering pens. The yards should be fenced off in the corner of the lambing-paddock, with strong stakes driven well into the ground and just the length of a hurdle apart. Wire the hurdles to the stakes, leaving a gateway close to the main fence. Then make up bundles of straw or brush and stand them on end on the other side of the fences, particularly on the side that the prevailing wind comes from during the lambing-period. Tie the bundles there with light wire, flax, or binder-twine, also round the part where the hurdles are fixed. Now fix up the pens, which will require to be large enough to allow the ewe to move about comfortably. Fasten one end of the hurdle to the fence where the straw is placed, and drive in a stake to fasten the other end to. Having fixed up the number required, put another hurdle across the front, making one end secure and leaving the other loose until the pen is required for use. Put a few rails or battens along the tops of the pens and place straw on these. This forms a roof and helps to keep the ewe quiet when put in, besides giving her and the lamb protection from rough weather. This sort of lambing-yard will be found especially useful for merino ewes that have been mated with longwool rams.

When a ewe requires assistance drive her up to the yard quietly, give the necessary attention, and put her and the lamb into one of the pens, closing and fastening the gate. Sometimes a ewe can be assisted out in the field and will remain with the lamb, but in some cases the lamb is deserted and has to be penned with its mother if practicable. When a lamb dies after being dropped it should be skinned, the carcase buried, and a lamb should be taken away from a ewe which has more than one. Then pull the dead lamb's skin over the live one, and put the lamb in one of the pens with the ewe which has lost her own until she mothers it

With most of the longwoolled breeds the following plan can be adopted with safety. When going among the ewes that are lambing carry a supply of binder-twine and a few dog-collars. Catch any ewe that has left her lamb and will not take to it, put a collar round her neck, and fasten her with a short length of twine to a stake or a post in the fence, leaving her there until she has taken to the lamb properly. This allows the lamb to draw the milk without being knocked about. The same can also be done with a ewe which has lost her lamb, and with which it is intended to put a foster-lamb. When the ewe has taken to the lamb they can be let go.

—*J. G. Cook, Live-stock Division.*

THE ORCHARD.

EARLY SPRING WORK.

THE stone-fruit trees will commence to make new growth early in August, and the pip-fruits at the beginning of September; the respective prunings, generally, should be completed before those dates. This operation affords an excellent opportunity for the close inspection of individual trees. Full advantage should be taken of this opportunity to mark trees specially infected with disease, to carefully pull any suckers growing from the roots, to treat any large branches that are broken or sprung, and to trim wounds made by implements and give them a dressing of tar.

Just before the buds of the stone-fruit trees start to swell an application of bordeaux, 8–6–40, should be made for the prevention of leaf-curl, brown-rot, and shot-hole fungus—all serious diseases to which these trees are prone. Trees of this kind suffering from scale or aphis parasites should be further sprayed with red oil, 1–20, before bud-movement. Further spraying of orchard-trees can then be deferred until September. There is only one way of mixing bordeaux spray effectively, and that is to dissolve and fully dilute each ingredient before mixing. It is a little troublesome to place diluting-tubs on hand in a suitable position, but once this is done the correct method is as quick as any other way.

Considering the amount of spraying to be done, growers accustomed to fill their spray-tanks through small taps or by bucketing water out of creeks or dams are strongly recommended, on the score of economy, to adopt better methods as soon as possible. Elevated water-tanks with a 2 in. faucet form the best method of supply, but where water has to be picked up from dams or creeks a good horizontal hand-pump should be used.

The orchard should be ploughed now as soon as it is sufficiently dry; make a clean neat job, turning the land over close up to the trees and carrying the ploughing as near the fences as it is possible to get.

An important factor in successful modern horticulture is the proper use of manures. Varieties of orchard-trees such as are grown in this country, selected for early maturing and heavy cropping, cannot maintain these characteristics without generous manuring. Neglect in this respect means a debilitated tree, susceptible to disease and easily burnt by sprays. A very satisfactory treatment has been to harrow in a dressing of superphosphate and sulphate of potash after the first ploughing, followed by a dressing of nitrate of soda or sulphate of ammonia as the trees come into blossom; but, of course, each orchard must be studied separately if successful manuring is to be accomplished. Locality, pervious treatment, and kinds and varieties of trees are some of the points which have to be taken into consideration. Strong-growing Winter Cole pear-trees obviously do not want the forcing of nitrates as do rather stunted Sturmer apple-trees. If in doubt the local Orchard Instructor may be consulted in this matter. Trees that are well conditioned by proper feeding with manures are more resistant to disease, and will stand stronger sprays and bear fruit of superior quality.

Any planting contemplated is best finished during this month. Hares and rabbits are usually troublesome at this season of the year, especially among young trees; they do not confine themselves to these, however, in a hard season. Almost any spray applied to the butts and lower branches renders these distasteful, and is an effective deterrent.

Keep a close watch on fruit in store, and note developments. The last of the earlier varieties should be cleared during this month.

—*W. C. Hyde, Orchard Instructor, Nelson.*

FIREBLIGHT.

Now that the pruning season is at hand all growers of pip-fruit trees in any part of the Dominion, whether they are resident in an area in which fireblight is known to exist or not, are warned to keep a sharp lookout while engaged in pruning operations for any suspicious cankers on apple, pear, or quince trees. Past experience of the hold-over canker of this disease goes to show that delay in removing any parts which may appear suspicious is extremely dangerous. Even if a canker attacking a pip-fruit tree should be proved not to be a fireblight hold-over canker it would undoubtedly be better removed and immediately burnt.

When the canker has been removed, cut well below the bark or cambium discoloration and thoroughly sterilize the wound by swabbing with the formalin solution mentioned below, or a mixture consisting of 1 part corrosive sublimate to 1,000 parts of water—that is, one tabloid to 1 pint of water. Apply with a small brush. The latter is a deadly poisonous compound, and every care should be taken in its use. After sterilizing the wound should be painted with a mixture of creosote and tar.

When engaged in the work of removing suspicious cankers from fruit-trees all knives, secateurs, &c., used in the operation should be sterilized after each cut by immersion in a solution of 1 part formalin diluted with 20 parts of water.

Growers in any part of the Dominion are reminded that it is as well to keep a sharp lookout for fireblight-infected hawthorn in any hedges adjacent to their property, and if any doubt exists as to the actual infection of any part or parts of a hedge the advice of the local Orchard Instructor should be sought.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

HATCHING-TIME.

POULTRY-KEEPERS who have not commenced hatching operations are reminded that August and September are the best months to have the chicks hatching out, those brought out later than this seldom proving satisfactory. No time, therefore, should be lost in securing the required number of stock. In many cases, of course, hatching operations will be delayed till October, or even later, owing to inability to secure broody hens. The poultry-keeper who is really anxious to secure the greatest profit from his undertaking will, however, not waste time waiting for broody hens, but will adopt artificial methods, and thereby be able to have all his stock hatched out at the right time. It is now recognized that the maximum returns cannot be secured from poultry unless late autumn and winter eggs are produced in good numbers. It is also recognized that the pullets must be chiefly depended upon to produce these, and to do so they must be hatched out early.

This involves the adoption of artificial methods, as on most plants it is impossible to secure the desired number of broodies when they are required. Even on the farm artificial methods must be resorted to. The chief reason why the farmer does not get winter eggs is because the greater number of the fowls kept by him have passed their best period of production, or that, having been bred at the natural season, the birds lay when nature dictates and take a rest during the dear-egg season. While a variation of price between summer and winter eggs will always be experienced, there is no reason why the selling-price should fluctuate between 1s. and 3s. 6d. per dozen.

FARM POULTRY AND ITS POSSIBILITIES.

The last census returns showed that there were 3,991,009 head of poultry stock in the Dominion, and that the average flock consisted of two dozen birds. Obviously, this goes to show that the great bulk of the poultry in the Dominion is on the farms. Nevertheless, it is safe to say that few high-priced eggs come from the farmer. They are chiefly supplied by poultry-keepers who specialize in the business, hatching eggs from tested stock at the right time, and feeding and managing their birds on the best principles. Of course, the extra profit made on winter eggs justifies the special effort to secure them. No doubt farms in general,

or at least the womenfolk of the farm, find the keeping of poultry a profitable side-line, having regard to the general low cost at which the fowls are maintained. The present revenue, however, is nothing to that which would be secured were the farm poultry handled to the best advantage.

If more eggs are to be secured next autumn and winter the farmer must, first of all, guard against having late-hatched stock. Even with light breeds such as Leghorns, the birds will not lay till the spring if brought out later than September. It is always better to hatch out on the early side rather than on the late side. It should be always remembered that the laying-year ends with the moult, so that the late-hatched bird has no opportunity, having regard to the short season available, of producing a good egg-yield during the pullet-year.

Where it is not convenient to use incubators a good means for the man in a small way to overcome the drawback to timely hatching is the facility now being offered of securing day-old chicks from reliable breeders of high-type laying stock. With fireless brooders, where the necessary attention is available, these chicks can be satisfactorily brought to maturity. Chickens can thus be secured at a season when they will have every opportunity of developing well, and of coming to their laying season at the most profitable stage of the egg-market. On the small plant the day-old-chick business, as well as the fireless brooder, has come to stay, though if it pays one man to hatch day-old chicks for sale it will surely pay the farmer to artificially incubate on a small scale for himself. The problem, after all, is the rearing of chickens rather than the hatching of them, and if a man can rear successfully he should certainly be able to manage the more simple process. Artificial incubation and brooding have passed the experimental stage, and with a little care and attention no difficulty is now experienced in providing sufficient pullets each year to ensure a good supply of eggs in the dear season. With the up-to-date incubators and brooders now available persons with an ordinary amount of intelligence can soon master their working. Naturally, where possible, the beginner is advised to get a few lessons from a practical operator and thus gain the benefit of his experience at the outset.

Because a person is capable of working an incubator or brooder successfully it does not necessarily follow that the best results will be obtained. The first essential in securing good hatches of chickens that are easy to rear is to have strong. vigorous breeding stock that are not overfat, and which have not been and are not being overforced for egg-production. Usually it is a weak policy to buy a cheaply built incubator, or one of those which find their way to an auction-mart. These are mostly amateur-made or out-of-date machines, which in many cases have been discarded by the person of experience. Obviously, if he is installing more up-to-date and better machines the novice should do likewise.

Farm poultry-keeping is capable of great expansion in New Zealand, especially among those who are working the smaller holdings. The first thing necessary to make farm poultry pay is to keep the correct type of bird, and only such numbers as can be effectively handled and properly fed and looked after. They should not be left to hunt for their living and remain till they die of old age. Many farmers still declare that there is no money in poultry, and that the average farm hen dies in debt to her owner. This is because they have not given the noted egg-laying strains a trial under modern methods of management. It is on the farm that eggs should and can be produced at the cheapest cost, but the maximum returns will never be secured unless the poultry are given as much care and attention as other animals on the farm. Like the heavy-milking cow, the modern high-type laying-bird will not maintain its great artificially stimulated yield unless well fed, sheltered from adverse weather, and treated in a kindly manner. I do not contend that it will pay to take up poultry on a large scale on the average farm except under special conditions—for instance, where there is a daughter or a son who takes a keen interest in them.

There are few farmers in the Dominion who do not keep poultry to a greater or lesser degree. These notes are not written specially with the object of inducing farmers to increase the number of their fowls, but rather to impress upon them the advantages of keeping a better class of poultry and managing them on sounder lines in order that they may furnish increased returns. It is safe to say that on the majority of farms if only half the number of good young birds were kept, and these were properly fed and managed, they would furnish a better income than is obtained at present. Farmers and others who are really anxious to make the most profit from their poultry are advised to obtain a copy of the Department's Bulletin No. 66, "Utility-poultry Keeping," in which useful information is contained on

practically all branches of the industry, and to which these *Journal* seasonal notes are supplementary. This bulletin may be obtained from the Publisher, Department of Agriculture, Wellington, at a cost of 1s.

HATCHING WITH HENS.

Those who are hatching with hens should take care to have ample provision for cosy coops and runs for the chicks. The coops should be placed on dry ground, and made in such a way that the mother and her brood will be protected from rain and cold winds. It is also essential that they be made cat and rat proof; neglect of this provision means heavy losses of chickens each season. In making the nest take a shallow box about 6 in. deep and 15 in. square, remove the bottom, and place on the ground. Half fill it with moist earth, and shape the nest with the hands so that the eggs will have a tendency to remain in the centre; in other words, make it saucer-shaped, care being taken that it is flat on the bottom to enable the hen to turn the eggs, which she does several times a day. Neglect in this direction is a common cause of eggs being broken in the nest. The nest should be lined with a thin layer of hay, fine straw, &c.

Place the hen on a few china eggs until satisfied that she can be entrusted with the eggs intended for incubation. Before the hen is placed on the nest give her a good dusting with carbolic or other insect-powder in order to destroy any vermin that may be on her. More trouble and loss are occasioned by vermin in the rearing of chickens under hens than by anything else. Do not meddle too much with the hen when she is hatching. She can attend better to her natural business than you can, but as she is not carrying out her work in a state of nature her requirements must be considered. The application of moisture to the eggs is a case in point. Sometimes the air-cell dries down to such an extent that the thin membrane inside the shell becomes so tough that the chicken is unable to pierce it and consequently dies of suffocation. Here nature may be assisted by providing moisture. The best means is to take the hen off, lift up the nesting-material, and give the earth underneath a good moistening. This is preferable to sprinkling moisture on the eggs or dipping in water. The object should be not to wet the eggs, but by applying the submoisture to encourage, by means of a hen's body, a humidity in the air surrounding the eggs.

When the chicks are moved to the coop, which should be constructed in such a way that plenty of fresh air and light are provided, both the hen and the chickens should be enclosed for the first two or three days. Then provision should be made whereby the chickens can run in and out in order to afford them exercise. It is always a mistake to allow a hen with a young brood a free range. When the sitting-hen is confined in a box she should be let off once a day to feed, drink, and dust herself. It is, however, much better for her if she is placed in a coop with a roomy run attached; she can then have before her at all times everything she requires, thereby minimizing the time required for attending to her. Hard grains, clean water, and grit are all the food that a sitting-hen needs.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FOUL-BROOD.

It is evident from opinions expressed by many beekeepers in reference to foul-brood that the highly infectious nature of the disease is not fully understood. In a bulletin on the subject, written by Dr. G. F. White, specialist in insect diseases, and issued by the United States Department of Agriculture, is given a brief summary of the facts known about American foul-brood (the form present in this country), together with a few conclusions, which may be usefully quoted here, as follows:—

"American foul-brood is an infectious disease of the brood of bees caused by *Bacillus larvæ*.

"All larvæ—worker, drone, and queen—are susceptible to the infection; adult bees are not.

"The brood of bees can be infected through feeding the spores of the bacillus to a colony.

"The spores contained in a single scale are more than enough to produce considerable disease in the colony.

"The portal of entry of the infecting agent is somewhere along the alimentary tract of the larvæ, most likely the stomach (mid-intestine).

"The incubation period is approximately seven days.

"The brood is susceptible to infection at all seasons of the year.

"More brood dies of the disease during the second half of the brood-rearing season than during the first half.

"The course of the disease in the colony is not affected greatly, if at all, by the quality of food used by the bees, or by the quantity present.

"The spores of American foul-brood remain alive and virulent for years in the dry remains (scales) of larvæ and pupæ dead of the disease, and in cultures that have become and remain dry.

"The spores are very resistant to most destructive agencies. A variation in resistance is noted both as to the individual spores of a sample and as to the spores contained in different samples.

"Many of the spores are killed within one minute at 100° C., and all of them from some samples are killed in less than five minutes. In some instances 96° C., maintained for ten minutes, will destroy all of the spores, while 98° C. will often do it. The most resistant of the spores studied when suspended in water have not withstood 100° C. for eleven minutes.

"The spores withstand more heating when they are suspended in honey or honey diluted with water than when suspended in water.

"The spores suspended in honey or diluted honey can be destroyed by 100° C., but it may require half an hour or more to do so.

"American foul-brood spores, when dry, were destroyed by the direct rays of the sun in from twenty-eight to forty-one hours.

"The spores, when suspended in honey and exposed to the direct rays of the sun, were destroyed in from four to six weeks.

"The spores, when suspended in honey and shielded from direct sunlight, remained alive and virulent for more than a year. It is very likely that they are capable of remaining so for a very much longer period.

"The spores resisted the destructive effects of fermentation for more than seven weeks at incubator and outdoor temperatures respectively, and probably are able to withstand these agencies for a very much longer period.

"The spores resist carbolic acid at room-temperature in strengths ordinarily used as a disinfectant for periods of months; 1–1,000 mercuric chloride, for days; 10-per-cent. formalin, for hours.

"American foul-brood infection is transmitted primarily through the food of bees; possibly at times to some extent through their water-supply. Robbing from the diseased colonies of the apiary or from neighbouring apiaries is the most likely mode by which the disease is transmitted in nature.

"The placing of brood-combs containing diseased brood with healthy colonies will result in the transmission of the disease.

"Flowers should not be considered as a likely medium through which infection may take place.

"Whether the disease is ever transmitted by queens or drones has not been determined. That they have been overestimated at times as possible sources of infection seems likely.

"It is quite probable that in many cases hives which have housed colonies infected with American foul-brood will not transmit the disease to healthy colonies transferred to them. Results from the present studies confirm the observation made by beekeepers that danger from this source may be removed by properly flaming such hives inside.

"The clothing of those about an apiary, and the hands of the apiarist, are not fruitful sources for the transmission of the disease.

"Tools and bee-supplies generally about an infected apiary will not transmit the infection in the absence of robbing from those sources.

"American foul-brood usually can be diagnosed from the symptoms alone. A definite diagnosis can always be made from suitable samples by bacteriological methods.

"The prognosis in the disease in the absence of treatment is decidedly grave, but with proper treatment it is favourable.

"From the technical viewpoint many of the problems considered in these studies have been solved only partially; from the practical point of view, however,

the results are sufficient to make a logical, efficient, and economic treatment of American foul-brood possible."

Dealing with the spore stage of the disease, Dr. White says: "Scales of American foul-brood obtained in 1907 from colonies in which the disease had been produced through experimental inoculation were stored in the Laboratory. Each succeeding year for nine years tests were made relative to the viability of the spores in this material. In 1916 they were still alive and as resistant to heat and as virulent as at any previous time. It is most likely that they would have withstood the drying at room-temperature for a very much longer period than nine years."

—*H. W. Gilling, Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

SEED-SOWING as advised last month is appropriate for the coming month also; arrears should be brought up as may be convenient.

Turnips can be sown generally. Extra Early Milan is probably the quickest variety to sow, but only a small breadth of this should be sown, to be followed by Snowball, which is a better variety, and takes very little longer to come into use. Where the seeds are sown by hand the drills can be conveniently made with the end of a rake, holding it flat so as to make a broad and shallow drill. The seeds should be sown rather thinly, covering the full breadth of the drill. Broad rows result, which require very little thinning if roots are pulled as they become large enough for use; a large crop is obtained from comparatively little space.

Early Horn carrots should be sown for the first crop. Sow as described for turnips, and a heavy crop can be taken. The roots of the Horn varieties are usable when very young and small. Thinning the rows as roots are wanted for use allows those left space to increase in size, and the crop will carry on till the larger varieties, sown later on, come into use.

Where red beet is required for use during the summer months a turnip-rooted variety should be sown. These varieties come in quickly, but they are not so good for winter use as the long varieties, which should not be sown till November.

Turnip-rooted parsnips are useful in summer. They may be sown now if they are wanted, but long varieties alone are suitable for winter use, and should not be sown till November, or possibly October in colder districts.

Celery for first crops should be sown in boxes under glass. Use a compost of clean loam with a good proportion of old manure and coarse sand to give it body. Sow rather thinly, and prick off the seedlings as soon as they can be handled; crowded seedlings are difficult to deal with because they are very weak. Henderson's White Plume is the best variety for early crops.

Rhubarb of the summer varieties should be planted at once in rich soil. Plant in rows 3 ft. apart, with the crowns 2 ft. 6 in. apart in the rows. The crowns should be barely covered with soil. Any one intending to establish beds from seeds should sow at once. The seeds may be sown in rows just far enough apart to allow for hoeing and weeding. Drop the seeds 3 in. or 4 in. apart in the rows. When the seedlings are large enough they can be lifted and planted afresh, allowing space for further development. It should be understood that seedlings vary very much in character, and selection later on is necessary for the establishment of a good-paying strain.

Winter rhubarb should be in full use. If it has not lately been manured an application should be made now; failing stable or farmyard manure a good dressing of fowl-manure will answer. In either case a dressing of nitrate of soda, 2 oz. per square yard, should also be given.

Tomato-seed for open-air crops should be sown; it has already been sown in the warmer districts; but in other places the latter half of August is early enough. All the evidence is against planting out too early; among other things, sleepy disease from the pathogen usually experienced in this country is attributable in the main to planting too early. No artificial fertilizer of any kind should be mixed with either the soil for sowing seeds or that used for pricking off the seedlings.

The soil should be prepared for new plantations of asparagus, but planting should be deferred till the young plants begin to move. In most cases this is early in September.

SMALL-FRUITS.

Strawberries.—The time for planting varies in accordance with climate and conditions of soil; also it is largely ruled by the purpose for which they are grown. In commercial plantations in the North planting is done in autumn, being usually completed by the end of April, and the plants are renewed every year. In some places in the South Island planting is done in spring, and a full crop is not expected till the following year. In both cases the magnitude of the operation forbids slow ways of planting, which accounts for the small crop obtained the first year in some places in the South. In the northern plantations the plants have time to get a good root-hold and to improve the crowns before flowering begins. The case of the small grower is different, and methods involving a proportionately greater amount of labour are possible. Autumn planting is not practicable in a climate where the soil cannot be cultivated in the winter, because it would in most cases become covered with weeds, which mostly would have to be pulled out by hand. Moreover, in such circumstances the plants would do very little good during winter, and the soil would be battered down by rain and become unwholesome. It is best, therefore, to leave planting till spring. The plants should, however, be secured in autumn—about the month of March—and be planted in temporary beds in well-drained soil, spacing each plant 3 in. or 4 in. apart. In this position roots are freely made, and by spring there will be fine plants, which can be lifted with a fork, with roots intact, and planted early in August with scarcely any check. Such plants will produce a good crop the first year, being in practically the same condition as the plants set out in autumn in the northern plantations. Where leaf-spot is troublesome spray the plants with 4–4–40 bordeaux.

Loganberries.—Planting should be completed as soon as possible. Cut the young plants down to one or two good buds. For commercial purposes the plants should be set about 12 ft. apart in rows 8 ft. apart, and a trellis erected to support the rods. The erection of the trellis may be left till the following year, the growth made in the meantime being supported by stakes. In a domestic garden the rods may, if desired, be trained to a fence or the wall of a building. In this case the usual plan of renewing the rods every year can be departed from, keeping them to fruit two years instead of one. The side shoots that have borne fruit should all be cut back to two buds at their base. Before growth begins loganberries (also raspberries and gooseberries) should be sprayed with 6–4–40 bordeaux.

Cape Gooseberries.—Plants that are to stand another year should be cut down to about 6 in. from the ground. In places where frost occurs the branches will be cut or killed, and in these cases the tops should be left till frosts are over. In the meantime new shoots will appear at the base, which the branches, though they may be dead, will shelter. Seeds to provide new plants should be sown at once if this is not already done. Personally, I like to sow in autumn.

—*W. H. Taylor, Horticulturist.*

ENTRY OF STUD STOCK INTO THE UNITED STATES.

INFORMATION has been received that Astoria, at the mouth of the Columbia River, Oregon, has been declared an additional port of entry for foreign live-stock. Importers, however, will have to provide suitable quarantine accommodation for any stock landed there. It is considered that this new facility will be of decided advantage to the import business in sheep from New Zealand. Breeders in the Oregon and Washington sheep-raising districts have long objected to their purchases being landed at San Francisco or Vancouver, owing to the knocking-about the animals are liable to on the subsequent railway journey. It is stated that a valuable Romney ram from Southland had two legs broken on the railway journey between San Francisco and southern Oregon.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

DISTINGUISHING COWS UNDER TEST.

C. F., Pakaraka :—

Would you be so good as to tell me the best plan for branding a dairy herd of seventy cows? The object is for keeping a weight and test record, names being unsatisfactory. I thought numbering on rump would be the best thing. Is there not a paint brand that can be stencilled on and yet become a permanency?

The Live-stock Division :—

The subject of distinguishing cows under test has been given considerable thought, and it is still held that naming the cow is the most convenient method, and is the one generally in use. It has to be remembered that branding a number on the animal with the hot iron or liquid branding-fluid is not permissible under the Stock Act, which requires registration of all brands. Painting the number on cannot be said to be of any value, as it is usually obliterated in a short time.

SUMMER FORAGE CROPS FOR EWES AND LAMBS.

"INQUIRER," Dromore, Canterbury :—

Could you suggest any crop which could be put in here during August or September to provide feed for ewes and lambs about November and December? We have found that neither ewes nor lambs do well if left on autumn-sown oats during those months, and if the weather is dry the grass is then going off. Rape does not do well here if sown before November, and lucerne appears to be hard to establish on this class of land.

The Fields Division :—

Owing to local conditions your scope is somewhat limited, but the following crops may be suggested for green feed from November to January: (1.) Spring-sown oats (2 to 3 bushels Algerians) sown in September, with 1 cwt. superphosphate per acre. (2.) Cape barley (2 to 3 bushels) sown at end of September, using 1 cwt. super per acre. (3.) Black Skinless barley (2 to 3 bushels) sown at end of September, with 1 cwt. super per acre. (4.) Western Wolths, 25 lb., and cow-grass, 4 lb., sown at end of September, with 1 cwt. super per acre.

LAMBS WITH SORES ROUND MOUTH.

W. G. BONNER, Rahotu :—

I should be pleased if you would inform me the cause of, and remedy for, a number of my lambs breaking out in sores around the mouth. In one or two cases the upper lip is quite swollen, and the sore is very raw; in others the soreness is along both the upper and lower lips; the inside of the mouth is not affected. The paddock they have been grazing on (grass, old pasture containing rushes and cutty-grass) is very low-lying, and owing to the continual rain is very wet. I have removed them to a hilly paddock and isolated the ones affected.

The Live-stock Division :—

The primary cause of this condition is excessively wet pasture. The tissues are softened and then injured by the grasses, thus affording an entry for organisms. As carried out by you in this case, the lambs should be removed to dry pasture and the affected ones isolated for treatment. Hand feeding should

be resorted to in the meanwhile. The parts should be bathed daily with a warm, weak solution of either Jeyes fluid or lysol, and then a little of the following ointment applied: Carbolic acid, 1 dram; eucalyptus-oil, 1 dram; zinc oxide, 3 drams; and vaseline, up to 4 ounces.

POLLINATION OF FRUIT-TREES.

R. W. WRIGHTSON, Ohingaiti :—

I have a Moorpark apricot-tree, now five years old, which has bloomed for three seasons, but has had no fruit. The nearest apricot-trees are three miles away. Is it necessary for me to have another tree to obtain fruit?

The Horticulture Division :—

It is only in recent years that it has been realized that some varieties of fruit-trees are sterile to their own pollen. Only by very careful observations carried out over several years can a determination be come to as to whether a variety is or is not sterile in this way. Apricot varieties have not yet had this attention, therefore we have no certain knowledge with regard to this fruit. It is, however, an established fact that even varieties of apples and pears that are perfectly self-fertile are made more fruitful by interpollination with another variety, and it is reasonable to suppose the same applies to other fruits. For this reason we never advise the planting of one tree of any kind of fruit. With regard to apricots, it should be understood that they succeed in comparatively few places, also that they blossom very early, and frost may destroy the blossoms. If you decide to plant another tree it is necessary to select a variety that comes into blossom at the same time as the Moorpark which you have. Any of the following will answer: J. L. Budd, Harris, St. Ambroise, and Campbellfield Seedling.

AUTUMN-SOWN TEMPORARY PASTURES.

"PASTURE," Christchurch :—

Will you kindly state if it is a good practice when laying down a temporary pasture to sow the grass and clover with an autumn-sown crop of wheat? The grass-mixture, I understand, would be sown at the time of spring rolling. Also, if I plough in 4 in. wheat-stubble as soon as the crop is in stack, and give the land a good working with the grubber, would I be able to sow rye-grass in March with any chance of a good crop?

The Fields Division :—

The practice of sowing down temporary pasture in the spring on land which was seeded with wheat in the autumn is a fairly common one. A number of instances have come under notice this season, the resulting pasture in most cases being very satisfactory. The grower is somewhat at the mercy of weather conditions, for if a very dry harvest is experienced the young grass and clover plants are likely to be burnt out prior to or on sudden exposure to the sun. Though it is not the ideal method to sow perennial rye-grass on a hastily prepared seed-bed after wheat, there is no reason why the resultant crop should not be good if sown not later than March. Italian rye-grass can be sown under these conditions with a greater certainty of success.

CROSSING OF DAIRY CATTLE.

G. J. H., Owhango, King-country :—

I am dairying on a bush farm. The majority of my cows are grade Jerseys, and in calf to a pedigree Jersey bull. Taking conditions here at present, I seem to be as far into the Jersey as is advisable until I get more ground stumped and ploughed to provide winter feed. Two cows in the herd are Friesian-Jersey cross, and have tested and milked well through the season. Could you advise me if I would be doing a wise thing by using a Friesian bull on the Jersey cows? The climate here seems to suit the cross.

The Live-stock Division :—

We are of opinion that the use of a Friesian bull on Jersey cows is not to be recommended, principally because of the danger of the unusually large size of the head in the Friesian calf giving rise to difficulties at calving-time, more especially in small Jersey cows. However, a Jersey bull can be used with Friesian cows. With your conditions probably a better cross would be obtained by using an Ayrshire bull on your Jersey cows.

HORSE INFESTED WITH LICE.

"DIGGER," Lowcliffe, Hinds :—

I have a draught gelding very badly infested with lice: will you kindly advise treatment?

The Live-stock Division :—

The application of any coal-tar sheep-dip of good quality is a safe cure. It should be used in the same strength as for dipping sheep. The solution must be well rubbed in all over the animal's body with a stiff dandy-brush, and, for preference, a warm dry day should be chosen. The animal should be dressed again nine days afterwards, as the solution will not kill the "nits," or eggs, which hatch in seven or eight days. Sometimes a third dressing is required. All covers, &c., which have been in contact with the affected animal should be soaked in the solution for three or four hours and dried in the sun.

CONTROL OF POTATO-EELWORM.

W. H., Lyttelton :—

Would you kindly inform me if potatoes slightly infected with eelworm could be safely used for seed, and if the ground from which they were taken would affect a crop planted on it next season? Are there any effective preventives?

The Fields Division :—

Treatment in cases of field infection with potato-eelworm (*Heterodera radicicola*) consists in careful rotation of crops. No crop attacked by the worm should be sown on the same ground for a number of years. Plants attacked are tomatoes, cucumbers, potatoes, cabbage, turnips, lucerne, and certain fruit-trees, especially the peach. The refuse from a diseased crop will carry eggs for an indefinite period, and should be burnt. Infested tubers must not be used for seed purposes.

New Rabbit District.—The Eastern Pohangina Rabbit District, Wellington Province, has been constituted for the purposes of Part III of the Rabbit Nuisance Act.

"Diseases of Farm Animals."—Purchasers of this recently issued book are requested by the publishers, Messrs. Whitcombe and Tombs, Lambton Quay, Wellington, to communicate with them, and obtain an extra page containing an important correction by the author. This will be forwarded free of cost on receipt of name and address.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 7th July: *Peas*—Maple quietly steady with occasional small business for June and July shipments; July–August shipments sold 80s. per quarter; Tasmanian afloat offered at 95s.; spot trade slow; New Zealand offered at 95s.; Tasmanian 107s. 6d. ex store. Blue firmer, and influenced by speculative buying of Japanese; New Zealand to arrive sold at £18 10s. per ton c.i.f.; poorer quality colonial meets with poor demand. English crop reported backward. *Beans*—All requirements have been met by Home-grown. English horse in poor demand, selling at 8s. 9d. to 9s. 6d. per hundredweight. Pigeon in better request at 15s. to 18s.

WEATHER RECORDS: JUNE, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

METEOROLOGICAL reports for the month of June show a remarkable number of days with rain in the North; for instance, at Auckland and Hamilton there was only one day on which a measurable quantity of rainfall was not recorded. This, together with the lack of sunshine, accounted for very little drying on the land and the roads, and a wet and wintry season. Snow came low down on the Southern hills, and hailstorms and rain occurred frequently at night. Cold and fair conditions were prevalent in the east-coast districts, with an absence of high winds—as often occurs in the winter months, of which June is counted the first.

The total rainfalls for the month were above the average in the north and west-coast districts of the North Island, and were also in excess in Southland; but in most other parts, especially of the east-coast districts, the totals were below the means for the same month in previous years. Auckland City had a total fall 86 per cent. above the average; but, as if to compensate for its previous excess, Blenheim was 76 per cent. below the average.

Auckland experienced 86 hours of bright sunshine; New Plymouth, 92 hours; Weraroa (Levin), 95 hours; Wellington, 124 hours; Hokitika, 118 hours; and Nelson, 156 hours.

—*D. C. Bates, Director.*

RAINFALL FOR JUNE, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
		North Island.		
	Inches.		Inches.	Inches.
Kaitaia	8·66	22	2·22	5·53
Russell	5·58	18	1·52	6·28
Auckland	8·96	29	1·06	4·82
Hamilton	6·46	29	1·18	5·07
Kawhia	9·06	26	1·02	5·46
New Plymouth	8·98	26	1·43	6·21
Inglewood	13·13	25	2·53	10·54
Whangamomona	9·46	27	1·28	7·92
Tairua, Thames	8·28	24	0·96	6·95
Tauranga	4·48	23	0·78	5·09
Maraehako Station, Opotiki	6·04	19	1·18	5·68
Gisborne	3·80	10	1·82	5·21
Taupo	4·20	24	1·20	4·35
Maraekakaho Station, Hastings	2·94	13	1·36	3·44
Taihape	5·42	26	0·83	3·79
Masterton	3·03	14	1·26	3·41
Patea	4·37	20	0·84	4·40
Wanganui	3·91	17	0·63	3·29
Foxton	3·17	13	0·60	2·94
Wellington	3·40	12	0·84	4·92
		South Island.		
Westport	8·22	23	1·00	7·53
Greymouth	7·88	17	1·02	8·99
Hokitika	10·76	19	1·20	9·83
Arthur's Pass	6·02	9	1·65	9·77
Okuru, Westland	8·48	13	1·88	10·76
Collingwood	5·47	19	1·35	11·33

RAINFALL FOR JUNE, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Nelson	1·12	13	0·26	3·77
Spring Creek, Blenheim ..	0·77	8	0·30	3·23
Tophouse	2·92	14	0·57	4·99
Hanmer Springs	1·36	4	0·68	2·83
Waiau (Highfield)	1·68	6	0·60	2·33
Gore Bay	1·59	7	0·76	2·30
Christchurch	2·22	14	0·76	2·64
Timaru	0·64	10	0·18	1·84
Lambrook Station, Fairlie ..	0·78	5	0·44	2·06
Benmore Station, Omarama ..	1·56	8	0·54	2·06
Oamaru	0·45	4	0·16	2·11
Queenstown	4·57	10	1·18	2·41
Clyde..	1·58	10	0·46	0·98
Dunedin	4·06	16	1·04	3·12
Gore	7·00	19	1·90	2·76
Invercargill	6·32	23	1·01	3·60

IMPORTATION OF FERTILIZERS, JUNE QUARTER.

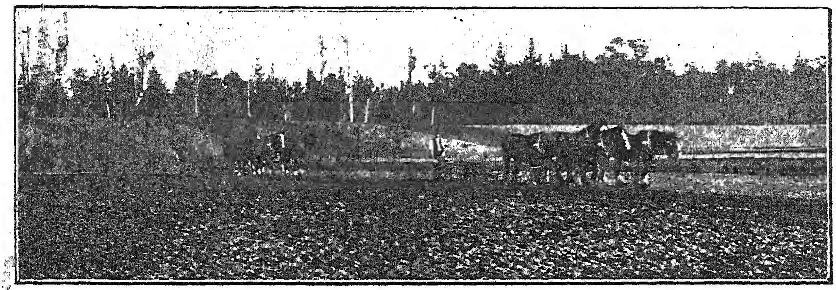
FOLLOWING were the importations of fertilizers into New Zealand for the quarter ended 30th June, 1923: *Sulphate of Ammonia:* Australia, 210 tons. *Gypsum:* Australia, 822 tons. *Nitrate of Soda:* United Kingdom, 30 tons; Chile, 50 tons; Belgium, 118 tons. *Basic Slag and Thomas Phosphate:* United Kingdom, 6,416 tons; Luxemburg, 600 tons; Belgium, 15,432 tons; United States, 1,000 tons. *Bonedust:* Australia, 1,350 tons. *Chardust:* Australia, 201 tons. *Guano:* United Kingdom, 19 tons. *Rock Phosphate:* Ocean Island, 750 tons; Nauru Island, 12,250 tons. *Superphosphate:* Belgium, 250 tons. *Kainit:* United Kingdom, 70 tons; France, 797 tons; Germany, 1,365 tons. *Sulphate of Potash:* United Kingdom, 20 tons; France, 55 tons; Germany, 415 tons. *Potash, other:* Germany, 150 tons. *Sulphate of Iron:* United Kingdom, 11 tons. *Fertilizers, other:* United Kingdom, 1 ton.

STOCK SLAUGHTERED, 1922-23.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1923:—

Stock.	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughterhouses.	Totals.
Cattle ..	125,483	155,881	..	67,035	348,399
Calves ..	24,620	7,504	..	1,843	33,967
Sheep ..	690,297	1,927,317	..	295,964	2,913,578
Lambs ..	109,256	4,410,895	..	25,642	4,545,793
Swine ..	112,761	86,351	22,661	22,089	243,862

Noxious Weeds.—Ox-eye daisy has been declared as a noxious weed in the County of Otorohanga.



The New Zealand

Journal of Agriculture.

Vol. XXVII.—No. 2.

WELLINGTON, 20TH AUGUST, 1923.

THE CATTLE-TICK (HAEMAPHYSALIS BISPINOSA).

INVESTIGATION OF ITS LIFE-HISTORY.

J. G. MYERS, B.Sc., F.E.S., Biological Laboratory, Wellington.

IN February last the writer was sent to the North Auckland tick-infested area for the purpose of studying in as detailed a manner as possible the life-history of the cattle-tick (*Haemaphysalis bispinosa* Neumann), which is attracting increasing notice as a pest of cattle, and to a less extent of other stock. The present article is a preliminary note on the progress of the investigation, with a view to placing before those concerned a few of the more salient and hitherto unknown facts which will be of assistance in the control of the pest. It will be perfectly obvious that a complete and definite account of the life-cycle of the tick cannot be obtained until there have been accumulated observations made through every month in the year. Almost all the life-history observations in this case have been made in the field, under conditions as natural as was consistent with the isolation frequently essential for accurate observation. It is now actually demonstrated for the first time that the New Zealand cattle-tick is a "three-host" species, in which it resembles such other members of the genus *Haemaphysalis* as have so far been studied.

LENGTH OF TIME CATTLE-TICK PRESENT IN NEW ZEALAND.

One of the most difficult portions of the investigation was the sifting of evidence from various sources on such aspects of the tick problem as could not be solved by an appeal to the verifiable facts of observation. There is scarcely a person in the tick-infested area who has not some opinion, more or less hazy, but not necessarily any the less strongly held, as to the length of time that has elapsed since the cattle-tick was introduced into New Zealand. This tick is a tropical species with its centre of greatest abundance in India and neighbouring regions, and it has therefore almost certainly been introduced accidentally into New Zealand by the agency of man. The probability is the more strong in view of the fact that this tick is essentially a parasite of mammals, and these latter were practically unrepresented in pre-European New Zealand.

A large part of the "evidence" for the existence of cattle-tick in the Dominion for thirty years or more could be rejected at once as utterly unreliable. The only spark of truth in it is based on records of the kiwi-tick (*Ixodes anatis* Chilton), a totally distinct species which the Maoris rightly assert to have been in the country from time immemorial. Mr. H. Munro, principal Inspector of Stock for the Auckland District, states that when he was inspecting the whole North Auckland Peninsula up to fifteen years ago the tick did not come under his notice in any way. The first occasion on which specimens actually came under the notice of an officer of the Department was in December, 1910. It may be concluded provisionally that there is yet no exact evidence as to the length of time the tick has been present in New Zealand.

There is a very prevalent belief, amounting in places to dogmatic certainty, that the cattle-tick was introduced from South Africa in saddles brought back from the Boer War by members of the New Zealand contingents. This is conclusively negatived by the fact that this tick does not occur in South Africa. Perhaps the favourite explanation is that it came from Australia when the grass *Paspalum dilatatum* was first introduced from there into the north of New Zealand. This on the face of it is a more likely theory, especially in view of the close association now observed between the cattle-tick and paspalum in the infested area. Unfortunately, however, for the theory, *Haemaphysalis bispinosa* is by no means widespread nor common in Australia, and has probably been only recently introduced there.

LIFE-HISTORY OF HAEMAPHYSALIS BISPINOSA.

The Eggs.

The very numerous dark-reddish eggs are laid on the ground in one batch. Their glossiness is due to a liquid secreted over them by a bilobed dorsal organ, the purpose of the secretion being to stick the eggs together. In this tick, as in foreign species, it has been shown that unless the eggs are thus kept together in one compact bunch they will not hatch, the failure being perhaps due to resulting desiccation. Egg clumps are deposited by the engorged female at the bases of grass and weeds, at no great distance from the spot where she fell from the cattle-beast or other host. In about two months the

eggs commence to hatch, but some three weeks before this occurs a conspicuous squarish white patch is visible on one side of the egg. This represents the accumulated excreted matter of embryonic development.

The Larvæ, or Seed-ticks.

From the eggs, now left as empty transparent horn-coloured shells, there swarm the very minute young ticks in the first stage of their active existence. In this stage they are known as "larvæ," or "seed-ticks." They are rather less than $\frac{1}{50}$ in. in length and nearly as broad, but very flat, and, in fact, before their first feed, almost transparent. The pale-yellowish almost whitish colour in which they first appear soon deepens to a darker brown, and the seed-ticks, which may be distinguished at once from all succeeding stages not only by their minute size but also by their possession of only *three* pairs of legs, proceed to swarm up the stems of grasses and herbage, by means of which they can clamber on to the hides of cattle or other stock. On such vantage-points as the tall seed-heads of paspalum they will remain day and night until a suitable host should happen to brush past.

Once on the host the seed-ticks soon thrust in their mouth-parts and commence to feed upon the blood and lymph. In the early stages these minute ticks may be present in incredible numbers on a beast and yet be entirely overlooked. Even when recognized as ticks it is quite a frequent occurrence for their connection with the cattle-tick to be stoutly denied. The writer has known the larval ticks and those of the succeeding or nymph stage to be distinguished as "horse-ticks." The bestowal of this name is worthy of a little digression. Larval ticks so soon as or a very few hours after they have pierced the skin of a horse raise a small lump, which shows at a considerable distance, by interrupting the sheen of the coat, though the minute seed-tick itself, each one seated on such a lump, is invisibly hidden beneath the hair. Even on parting the hair over a lump there are ten chances to one against the larva being seen, since the lymphatic exudate caused even by this minute irritation soon more or less hides the tick from view beneath a covering of scurf, to the scales of which the tick itself bears a considerable resemblance. On cattle, on the other hand, apparently no lumps are formed, and as a result an infestation of larvæ of as many as six to the square inch over a large part of the animal may be entirely overlooked. The farmer is not in the habit of focussing his attention on objects so small as an unfed larval tick, and he appears to have some difficulty in seeing them when they are actually pointed out to him. Whenever the horses of a district show a plentiful supply of lumps due to larvæ it may be safely assumed that the cattle of the same district have an even greater number of larvæ upon them. It must be emphasized that the larvæ have no preference whatever for horses, but rather for cattle, but they are seen, even in extremely limited numbers, on the former, while on the latter they are almost always totally overlooked.

In a few days the larvæ begin to show an increase in size and to assume a dark blue-black colour, causing them to resemble, when fully fed, small beads of writing-ink among the white hairs of light-coloured hosts. This process of engorgement, by which the thin larval skin

becomes distended to its utmost capacity, takes on an average about a week, but depends to a certain extent on the position on the host. It is obvious that some portions of the animal might be pierced to better advantage with regard to blood-supply than others. Engorgement proceeds very much more rapidly towards the end, and the replete or full-fed larva disengages its mouth-parts from the skin of the host and drops to the ground.

For about three weeks, on an average, the shining-black full-fed larvæ lie upon the ground, hidden among the bases of grass and weeds near where they fell from the host. Early in that period the shining-black appearance is displaced by a misty almost mouldy look, due to the shrinking of the nymphal or next stage tissues from the distended and still stiff larval cuticle or "skin." At the end of the period the larval cuticle splits, and a pale-coloured nymph tick emerges.

The Nymph or Second Stage.

The nymph, although not so small as the larva, is still minute, and much less conspicuous than the replete larva from which it emerged. It may, however, be distinguished from the larva by the possession of four pairs of legs, as in the adult tick. After a longer or shorter period —at most a day—the nymphs, like the young larvæ, ascend herbage and thus reach a host—the second host of the individual life-history. Most of the remarks concerning the behaviour of larvæ on horses and cattle respectively apply also to the nymphs. Their period of heaviest infestation is, however, as will be shown in the account of the seasonal cycle, at a different time of the year. Both larvæ and nymphs attack almost any portion of the host, except where the latter happens to be a bird, when the head, for reasons of safety, becomes almost the sole point of attachment.

For a week or perhaps a little longer the nymphs suck the blood of the host until they are engorged. Then, like the larvæ, they drop to the ground and lie hidden among rubbish and vegetation, while the internal changes resulting in the conversion of the nymphal tissues and the engorged blood into the structures of the adult tick are consummated beneath the passive exterior. In about three weeks from the time of dropping to the ground the nymphal cuticle splits, and the adult tick, at first pale and rather soft, clambers out.

The Adult.

The adult is eventually of a deep rich-brown colour, the female rather larger than the male, but both quite flat and out of all comparison less bulky than the engorged female which corresponds to the farmer's more familiar conception of a cattle-tick. In this unfed state it is a matter of some difficulty to distinguish the sexes with the naked eye, but the vast majority are females. The males so far have proved very rare indeed. The males feed but little, and never engorge as do the females, so that the former sex keeps approximately the aspect of the female before she has commenced to feed. For this reason unfed females have been repeatedly taken for males and recorded as such.

As soon as possible after leaving the old nymphal slough and hardening its own integument the adult tick climbs herbage just as did the

younger stages, and awaits there the chance passage of a host. This is the *third* host of the individual life-history. Once on the animal the female soon settles down in a favourable situation. If the host be a cow the escutcheon and neighbourhood of the udder will be perhaps the most favoured spots. The male is said to wander over the host and to stay there much longer than the female, but the writer is not prepared to say much concerning this sex until more numerous examples have been observed. The female takes, on an average, when the host is a cow, a week in which to engorge, the greater part of the swelling which makes her then so conspicuous taking place during the last few hours. She then drops to the ground and takes such shelter as may be convenient. Observations on this stage are of the utmost value in control work.

For about a fortnight the female lies as well concealed as possible while the blood engorged is digested and finally elaborated into the substance of the numerous eggs which she then commences to lay in an almost continuous stream. The process of egg-laying may take as long as three weeks. Upon its completion—her labours ended—the female dies. This completes the life-cycle.

It should be borne in mind that all the foregoing observations, which are mainly averages from large series, have been made under the conditions prevailing from February to July inclusive. There remains, however, to be considered a seasonal incidence in the life-cycle, which can be definitely worked out in detail only after a year's observations have been completed.

THE SEASONAL LIFE-CYCLE.

The relative abundance of the various stages during February, as gauged by sweeping them from seeding paspalum where they awaited hosts, was approximately 300 larvæ, 1 nymph, and 5 adults. This clearly indicates that, for the present year at any rate, February was distinctly a seed-tick period, where the seed-ticks were derived from adults which were extremely numerous in the preceding December. If February–March, then, could be considered a seed-tick period it became difficult to see how eggs, as popularly assumed, could be the wintering stage. Observations in the field showed that this heavy autumn infestation of larvæ had practically all left the hosts by the middle of April. On the ground moulting had taken place as usual, and the resulting nymphs were found in May wintering at the bases of the clumps of rushes or wiwi (*Juncus effusus*) which are such a conspicuous feature of the northern pastures—rendered all the more noticeable by the close winter grazing. The replete or full-fed larval stage is swollen, smooth, shining, and easily seen, and it must therefore be advantageous for the tick to spend the winter in the far less conspicuous nymph stage. Much of the paspalum which has served as such excellent harbourage for the seed-ticks in February–March is in winter eaten to a close turf. The rushes, however, remain as compact stiff clumps. In the larger paddocks a few clumps of seeding paspalum are found not yet eaten. The majority of the nymph ticks winter in the clumps of rushes an inch or two above the surface of the ground. The overwhelming number of other wintering arthropods (insects, spiders, woodlice, and their allies) in the bases of these rush clumps, as compared with those in the shorter grass and in

the paspalum tufts, indicates the general suitability of these clumps as winter quarters. It is difficult to see how ticks could survive the winter in any numbers in short, well-grazed turf. The relation of this to the question of control is obvious.

The first ticks to appear in spring are these nymphs, which come forth from their winter quarters and seek hosts about the middle of July. From then until the following winter development apparently proceeds as indicated in the general life-history just described ; but the verification of this will depend upon and guide future field-work.

HOST RELATIONSHIPS.

Although cattle are indubitably the chief hosts of every stage of this tick, it has already been pointed out that horses may be extensively infested, especially by the earlier stages. The list of hosts is, however, very much larger than this, and includes most of the larger animals of the North Auckland Peninsula and a few small birds. A few seed-ticks have been taken on the introduced skylark, thrush, and house-sparrow. Probably the most important of the wild hosts, from a control point of view, is the hare, which carries all stages. Man himself is a not infrequent host, the seed-ticks being often quite a serious nuisance to children, who become infested when playing in the grass. The effects of the bite are in most cases little more than a temporary irritation ; but the writer would not dogmatize from his own limited experience, since the effects would doubtless vary both with individual ticks and with individual men.

One point needs further stressing than it has yet received. It is repeatedly asserted that the kiwi (*Apteryx australis* var.) and the sea-gulls (*Larus dominicanus* Licht. and *Bruchigavia novaehollandiae* Steph.) are infested with the cattle-tick and act as carriers. In the case of the kiwi this is totally incorrect, being based on the discovery of kiwis infested with *Ixodes anatis* Chilton, a different species of tick which does not attack stock. To the untrained observer all ticks look somewhat alike. Probably the case of the gulls is open to a similar explanation, since sea-birds of several New Zealand species are infested with *Ixodes eudyptidis* Mask., another of the bird-ticks. Up to the present, however, none of the gulls examined has shown any examples of ticks either of this species or of the true cattle-tick.

NATURAL ENEMIES.

In the existing literature on ticks much has been written about the length of time ticks can exist without food. Ticks have been kept in closed vessels for over two years without apparent harm. So far as the present species is concerned, the writer has a large number of seed-ticks collected from grass-heads six months ago and still quite happy and healthy. The relation of this amazing longevity to the question of control is not so important as is usually imagined,* and the reason can only be that those stragglers which do not find a host before a certain period has elapsed are carred off by natural enemies, thus rendering possible the quite exact delimitation of seed-tick

*Possibly the longevity is more important in the matter of the distribution of ticks in agricultural produce.

periods, nymph periods, and so on, without very serious overlapping. Undoubtedly the most important of these natural means of control are climatic conditions and birds. Among the latter the introduced starling (*Sturnus vulgaris* L.) stands pre-eminent. During a period when adult ticks are prevalent the starlings make a speciality of these, picking them from the cattle in the fields. No examination of starlings' stomachs at such a period has yet been made; but in Jamaica, where the value of insectivorous birds as tick-destroyers is widely recognized, the stomach of one bird was found to contain no fewer than seventy fully engorged female ticks. Starlings have not yet been shown to carry seed-ticks, but even if they did bear the usually slight small-bird infestation the harm done in this direction would be overwhelmingly more than counterbalanced by the destruction of adult female ticks.

SUMMARY.

Haemaphysalis bispinosa is shown to be a "three-host" tick—a fact which makes its control a more complicated matter than that of the North American or Australian "fever" ticks, both of which are "one-host" ticks. Cattle are the chief hosts, but other animals, including some of the introduced small birds, are infested. Kiwis certainly, and seagulls almost certainly, do *not* carry cattle-ticks as is generally supposed. The winter is passed as a nymph hidden at the bases of rushes and clumps of rough grass.

This article is to be considered only a preliminary statement. All acknowledgments to the large number of those who assisted in various ways and all references to literature are deferred until the complete report is ready.

NOTE.—Illustrations of *Haemaphysalis bispinosa* and other ticks will be found accompanying an article by D. Miller in the *Journal* for January, 1922.—EDITOR.

PASPALUM DIGITARIA AS A SAND-DRIFT BINDER.

MR. W. H. FIELD, M.P., contributes the following note: "Some time ago, acting on the advice of Mr. B. C. Aston, I tried growing one of the paspalum grasses (*P. digitaria*) in my grass-garden on the sandhills at Waikanae. This grass grows so rapidly and produces such strong shoots that I was induced to try it on a bad "blow-out" on the top of one of the grassed dunes near the homestead. It seemed to me a comparatively short time after this had been planted that I visited the spot again, when, to my astonishment, I found that the grass had become thoroughly established, was rapidly covering the loose sand, and had effectually stopped the drift. I am so impressed with the possibility of this grass that I am trying it on a much larger scale. Stock seem to be very fond of the grass, and possibly it may have to be protected from them in the early stages of its growth, but it is difficult to see how, with its strong rooting-system, they could exterminate it when once it had become established."

REDWATER IN COWS IN NEW ZEALAND.

A. R. YOUNG, M.R.C.V.S., Director of the Live-stock Division.

As the term "redwater" is commonly used by our settlers to denote a certain condition in cows, and is the one most frequently employed, it will be retained in these notes. It must be pointed out, however, that in veterinary literature technical terms are used which more clearly indicate the nature and cause of the different forms of redwater, and it follows that different causes must have different treatment. This explanation will serve to prevent confusion in the minds of readers of articles dealing with this trouble in other countries, where the cause is totally different from that in New Zealand, and for which the treatment recommended is unsuitable for conditions existing here.

In New Zealand redwater is not confined to any one locality, neither is it dependent upon soil conditions, as it has been found not only upon sour, damp country, but in variations from the heaviest to the lightest of dry soil. No live agent, such as ticks, is required to introduce the trouble into the animal. Redwater may appear upon any farm in the Dominion where cows are kept, but local conditions may be favourable or unfavourable for its development; it may assume a serious aspect, or the attack be so mild as to escape observation.

PREDISPOSING CAUSES.

Local conditions have a certain determining influence upon redwater. So far as we are aware, the disease has not been observed in male animals; but even if it has been noticed, the fact stands out clearly that it is only in cows that it gives considerable trouble and sometimes loss. As already mentioned, no locality is exempt from liability to an attack, the trouble is not caused by the agency of ticks, and male animals are seldom or never attacked. The field of investigation is therefore narrowed down practically to the cow. Here the first thing which will strike the practical stockman is that the trouble is closely associated with breeding-stock, and is more frequently observed just before calving or in a few weeks thereafter. There also would appear good reason for suspecting that some cows are more susceptible than others, as evidenced by the fact that with a number of animals upon the same feed and under the same conditions some become affected and others do not. It is further observed that the trouble cannot be put down to any one kind of feed, but that it can be definitely traced to excess of one kind of feed—be that turnips or young green feed. Even then, generally, all the cows are not affected, and their bodily condition does not appear to play a very important part in the matter.

We have therefore to fall back upon the idea that some animals are more susceptible to the trouble than others. This is an important point, and should be noted by all good stockmen who are building up a herd. Animals which suffer this year should be carefully identified for observation next year, for in building up a good milking-herd it is not sufficient only to note the external general appearance for

health and constitution and neglect the working of the internal organs. Therefore if an animal is found to be more susceptible than others to this disease she should be discarded, as susceptibility is undoubtedly hereditary.

It will have been noted from the foregoing remarks that the actual determining factor in redwater here is of dietetic origin. This is borne out by the well-established fact that immediate change of food alone acts as a prompt remedy, and that when the trouble is not too far advanced such change is all that is required.

SYMPTOMS.

As the term "redwater" implies, this discoloration is generally the first sign observed that anything is wrong with the animal. If, however, the trouble had been suspected earlier it would have been found that the animal was showing a touch of fever with a rising temperature, palpitation of the heart, and indications of diarrhœa. Later on, and often within a few hours, the urine discharged is of a dark-red colour with a peculiar offensive odour, and which on falling upon the ground produces an unusual amount of froth. The same odour may be detected in the breath, and even sometimes from the skin. Constipation now usually sets in, and all the symptoms already noted become exaggerated. The visible mucous membrane is pale, and the general appearance of the animal is that of great depression. If the vulva be examined its appearance is found to be peculiar, being of a dull leaden hue.

Very rarely discoloration of the urine may be observed due to other causes, such as internal injury after calving or injury over the back, but in such cases the colour of the urine is of a brighter red with all the appearance of diluted normal blood.

TREATMENT.

It has been demonstrated by practical stockmen that a change of feed is the first measure towards bringing about a cure. The next in importance is the administration of a laxative; this must be efficient, because in my opinion the accumulation of deleterious gases in the stomach and intestines has much to do with the redwater condition as it exists in New Zealand. A good drench for this purpose consists of ½ lb. each of Epsom and common salt, and 1 oz. of powdered ginger (if at hand, a tablespoonful of essence of ginger is preferable to the powder).

The animal should be housed and made as comfortable as possible, being kept warm and free from excitement. A drink of water with the chill taken off, to which has been added two or three handfuls of oatmeal and a tablespoonful of salt, should be offered about an hour after drenching. If collapse or general debility takes place the urine should be drawn off, as at this stage the bladder may refuse to function. Stimulants should also be given, and of these the most efficient is beer to the extent of a few bottles. In the convalescent stage great care should be exercised in bringing about a return to normal conditions. Hay, crushed oats, and a little linseed or other such dry feed should be given, and a salt lick provided.

In the great majority of cases this simple treatment will be found effective, but, of course, where the life of a valuable animal is at stake the services of a fully qualified veterinarian should, if possible, be procured.

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

IV. THE INSECTIVOROUS SMALL BIRDS.

J. G. MYERS, B.Sc., F.E.S., R.A.O.U., and ESMOND ATKINSON, Biological Laboratory, Wellington.

AMONG the bird inhabitants of any country there is a certain number of kinds of small birds which live entirely on insects and other small forms of life, without exhibiting any failings which might detract from the benefits they confer on agriculture. The present article deals with some dozen species of indigenous birds which in this manner represent a summation of all that is beneficial in bird-life so far as the war against insect pests is concerned.

In Canada there has recently been secured exact numerical evidence of the value of insectivorous birds (Dunstan, 1922). The white-marked tussock-moth (*Hemerocampa leucostigma* S. and A.) is perhaps the worst pest of shade trees of all kinds throughout eastern Canada. In an investigation into methods of control it was found that " the type of infestation in the cities differed greatly from that found in the woods " — that is, under natural conditions. In the cities periodic outbreaks, in which the caterpillars appeared as a veritable plague, seemed almost inevitable, but in the forest " the insect was always present in small numbers, evenly distributed, but never in a state of outbreak." To ascertain the cause of this surprising difference a year was spent in the woods, and the insect studied under natural conditions from egg to adult. The insect passes the winter in the egg stage, in masses deposited on the branches of trees and in crevices of the bark, and it was found that a very large percentage of these egg masses was searched out and destroyed by birds. In the cities, on the other hand, in the absence of insectivorous birds, the egg masses went almost entirely free. To obtain an accurate estimate of the part played by birds in thus helping to keep this pest in check, caterpillars and pupæ (resting stage) were exposed and watched. On the basis of these experiments it was demonstrated that over 80 per cent. of the eggs laid under natural conditions were devoured by birds. Nor did their work cease here, for over 11 per cent. of the caterpillars which hatched from the surviving eggs were discovered and eaten by the same assiduous searchers. Finally, of those caterpillars which escaped to spin their cocoons, 30 per cent. were destroyed by predaceous enemies, among which the birds were of no mean importance.

Such a case as this is typical of the activities of the insectivorous birds. They are to be ranked among the greatest of those forces which tend to restore the balance of nature when a favourable set of circumstances has allowed the abnormal increase of any particular insect pest. Since the whole of man's relation to his environment may be summed up as an upsetting of the balance of nature and an attempt to escape the consequences, it follows that the insectivorous birds must be ranked among his most efficient allies, without which, in the long-run, it is difficult to imagine how vegetation could survive.

There is now scarcely a country in the world which has not come to realize the importance to agriculture of its insectivorous birds. A. Godard (1917), writing in a viticultural periodical on conditions of vine-growing in France, pleaded for the protection of birds as the natural means of controlling insect pests. "Outbreaks of pests in agriculture always coincide with the disappearance of birds, and this is more felt in agriculture and viticulture than in forestry, woodland birds being less liable to destruction." In New Zealand, of course, the last remark does not hold, since forest-birds are here the most liable to destruction. "In South Africa [to quote an abstract of FitzSimmons's article in the *South African Journal of Science*, 1917] if the native birds were exterminated the human population would in a few years be reduced to a condition of starvation, while the ticks would destroy the domestic animals throughout the country. All natural checks to insect-increase, including parasites, diseases, and fungi, acting together with man's fight against the pest, are considered entirely inadequate, without the aid of birds, to prevent insects from sweeping all vegetation from the face of the world." These are strong statements, but the coldest logic can lead to no other conclusion.

In view of the spread of the cattle-tick in the North Auckland district the relation between birds and ticks in Jamaica is of the highest interest. Buckland (1917) states: "The increase in number of *Margaropus annulatus* (Texas-fever tick) in Jamaica during recent years is synchronous with the decrease of insectivorous birds. Examination of the stomach-contents of one bird showed the presence of seventy-four adult female ticks in an engorged condition. The Island of Jamaica is remarkably suitable for the breeding of cattle-tick; experience has shown that all imported animals succumb to tick-fever. It is therefore essential that, in some way, the insectivorous birds should be encouraged to increase." The subject will be resumed when the writers come to deal with certain introduced birds which destroy ticks in the north of New Zealand.

THE WHITEHEAD, THE YELLOWHEAD, AND THE BROWN CREEPER.

To come now to the insectivorous small birds of New Zealand, there is first a group of three species, the chief characteristics of whose beneficial activities have already been briefly indicated in the article on the birds of the forest (Part II of this series). These are the whitehead (*Certhiparus albicilla* Less.), the yellowhead (*Mohoua ochrocephala* Gm.), and the brown creeper (*Finschia novaeseelandiae* Gm.)—three birds fairly closely related and performing much the same functions in the zone and object of their insect-hunting. Both the whitehead and the yellowhead are small brownish birds somewhere about the size of a sparrow, but with pale-coloured heads, that of the whitehead—which is confined to the North Island forestry—being white, while the corresponding colour in the yellowhead—a South Island species—is yellow. Both are frequently called "bush-canaries." In those bush districts where the one or the other is still to be found the whitehead or the yellowhead—according to the Island in which the district is situated—shows a habit of consorting in flocks or small travelling-parties, keeping usually to the higher branches, flitting from twig to twig, and uttering incessantly a great variety of notes. When their curiosity is awakened

by the approach of a stranger the happy notes of industry and sociability give place, especially in the whitehead, to a harsh chattering cry, while the birds themselves descend to the lower branches to interrogate the intruder.

The brown creeper is smaller, with longer tail, and all the upper parts, nape, and back a deep and beautiful brown colour, contrasting somewhat sharply with the uniform whiteness of the breast and underparts. This little bird is confined to the South Island, in a few areas of which its busy flocks may still be seen in almost any patch of bush. The three birds just mentioned are all essentially forest-birds, and their economic value is to be translated in terms of forestry alone. Their nests are placed almost invariably in the deeper bush, and it will scarcely be necessary to describe them here. It is surely obvious that *any* nest found in the depths of the forest should, by virtue of its position, be sacred from the attacks of those who, for reward, collect birds' eggs. The only legitimate prey of such collectors is the eggs of the house-sparrow, which never nests far from settlement.

THE FERN-BIRD.

The fern-bird (*Bowdleria punctata* Q. and G.), the next bird on our list, is one of those peculiar recluse species confined to a particular habitat—namely, the densest swamp and the thickest bracken of the hillsides. In the latter locality it is less frequent than its name would imply. Unfortunately, the writers possess little exact information concerning the food habits of this bird, beyond the indisputable fact that it is practically entirely insectivorous. The almost total absence of many of the indigenous swamp-birds, including the fern-bird, or "swamp-robin" as it is called in the North Auckland district, from most of our phormium areas, coupled with the increased damage to the phormium-fibre industry by insect pests, renders it not improbable that a little investigation into the case of the fern-bird would be of some economic interest.

THE PIED AND THE BLACK FANTAILS.

In Europe a summer scene would be manifestly incomplete without one or two birds of the swallow family with their familiar flight, hawking for insects almost from ground-level to the upper atmosphere. The swallows and martins are among the most aerial of birds, taking their prey almost entirely on the wing, and taking it, moreover, among such insects as mosquitoes, which inflict supreme annoyance on man. L. Pasqualis (1915) pointed out that "so long as swallows are to be found in Venice there is no annoyance from mosquitoes, but when the birds migrate late in July these insects appear in swarms." But the use of swallows in Italy was recognized long before this date. We are told (Balfour, 1914) that somewhere between 1790 and 1812 the Commune of Marsciano, Umbria, "asked for a papal decree prohibiting the killing of nesting swallows for food because their destruction brought about insalubrity in the region, one reason being that the swallows feed on the small flying-insects so troublesome and hurtful to man and beast." And this was before the relation between mosquitoes and malaria had been discovered.

We in parts of New Zealand are troubled with numerous flying-insects—mosquitoes and sandflies—and in the absence of all birds of

the swallow family from New Zealand it might be asked what agency we have here to prevent the increase of such pests to intolerable proportions. Such an agency is undoubtedly to be found in the two species of fantail, the black (*Rhipidura fuliginosa* Sparr.) and the pied (*R. flabellifera* Gm.), which subsist almost entirely on flying-insects captured in their native element by a succession of the most amazing evolutions, rendered possible largely by the large fanlike tail which has guided the choice of the vernacular name. Few birds are better known to New-Zealanders. It will suffice for a description to indicate that the black species has deep sooty plumage and is far commoner in the South Island, while the beautiful pied kind is widely distributed over both Islands.

The fantails are among the tamest and most confiding of birds, and it is probably largely on this account that indications are visible of a growing sentimental regard for these birds, comparable to the affection displayed in England for the famous "robin redbreast." In the case of the fantails, for once sentiment is guided well, by the soundest if unconscious logic, and it must be obvious that such a sentiment is of incomparably more protective value to the birds concerned than all the legislation in the world. There can be few more efficient or better-equipped fly-catchers than the fantails. The bill is capable of opening to a considerable extent, and when so opened the sides of the gape thus displayed are fringed by an impenetrable hedge of stiff bristles, forming a fly-trap from which escape must be hopeless.

During the summer months fantails show a decided predilection for the vicinity of water, where flying-insects and particularly mosquitoes are well known to abound. In such situations, frequently on a slender bough directly overhanging the water, the fantails love to build their quite unmistakable wine-glass-shaped nest — a structure of the very neatest workmanship, with shallow cavity often lined with the shining down of young tree-fern fronds, and a tapering bottom, bound with spider-webs and resembling an inverted gnome's cap. The small, whitish, somewhat shortly oval eggs are blotched with pale brown, chiefly towards the larger end.

When feeding their nestlings both parents work extremely hard, returning time after time with beak crammed full of minute flies. One of the writers observed last season a nest of young pied fantails to which the parents brought no fewer than fourteen beakfuls in forty minutes, and this in spite of the presence of the observer, only a yard away, quite unhidden.

In winter, even more than in summer, the fantails show themselves in a considerable degree adapted to the alien conditions of settlement. It is no uncommon occurrence during the winter months for them to enter houses and other buildings, hawk systematically for house-flies through the rooms, and finally depart with the grandest nonchalance. We have even an authentic record of a fantail which was regularly let in at the front door of a dwellinghouse and suffered to depart when it had cleared from the premises its daily catch of flies. In Australia a fantail very closely related to our own is of the greatest use in that it destroys the sheep-maggot blowflies which constitute there such a serious pest to the farmer. Doubtless the same good service is rendered by our New Zealand species.

THE GREY WARBLER.

We have now to discuss the grey warbler (*Maorigerygone igata* Q. and G.), sometimes misleadingly known as "native wren," but more appropriately called riroriro in imitation of its beautifully trilled note. Quite as much as the fantails, though in itself not so conspicuous, the little riroriro has adapted itself to the conditions of settled areas—in some places to such an extent as to have become independent of the native bush. This adaptation has had two consequences: its services to agriculture other than forestry have been tremendously augmented, and its eggs have become liable to find a place in the collections of small birds' eggs bought indiscriminately by local bodies, &c. All may recognize without difficulty the grey warbler, with its sober grey plumage relieved by spots of white visible in the tail when it is expanded to aid the fluttering of this little insect-hunter at the tips of twigs too slender to support even its fairy weight. The nest is even

FIG. I. NEST OF THE GREY WARBLER. ABOUT TWO-THIRDS NATURAL SIZE.

[*Photo by E. B. Levy.*

less mistakable, and should be confused with the work of no other bird in New Zealand. It is a covered structure hung from often a slender twig, though rarely pendulous. The opening in the sides, rather nearer the top than the bottom, is so small as barely to admit more than the tip of a finger, and is frequently shadowed by a small porch. The otherwise capacious interior is almost filled with the softest feathers, in which lie the tiny pink-speckled eggs.

Few birds are so exclusively insectivorous as the grey warbler. At a period with even less apprehension of the true position than at present, when the colonists of Canterbury considered as pests all birds except the truly destructive ones they themselves had imported from England, Potts brought forward as proof of the innocence of the grey warbler a nest which a pair had built embowered in a heavily fruiting red-currant bush. The parent birds had actually to brush aside the ripe fruit when entering the portal of their nest, yet not a currant was taken.

Strictly speaking, our riroriro is not a true warbler, but its differences from the warbler family are in no sense related to its insectivorous qualities. Hence the following figures published in *American Forestry*, 1917, will be of interest as showing the rate at which insects are destroyed by these birds and their allies: "One palm-warbler was observed to catch insects at the rate of from forty to sixty a minute during a space of four hours, making a total of nearly 9,500, while another species feeding on aphids (plant-lice) on a grey-birch destroyed eighty-nine in a minute and 3,500 in forty minutes. The destruction of caterpillars is on the same scale, one warbler destroying twenty-two gypsy-moth (*Lymantria dispar*) caterpillars in fourteen minutes, another twenty-eight browntail (*Euproctis chrysorrhoea*) caterpillars in twelve minutes, and a third forty-two in thirty minutes."

THE WHITE-BREASTED AND THE YELLOW-BREASTED TITS.

The two New Zealand tits which are really fly-catchers (*Muscicapidae*)—the white-breasted tit or miro (*Myiomoira toitoi* Less.) of the North Island, and the yellow-breasted tit or ngiru (*M. macrocephala* Gm.) of the South—are tame and familiar little birds which, nevertheless, are not very frequent in cultivated areas, though both show a considerable liking for clearings on the edge of the forest. The males of both have the same colour scheme of plumage, with black upper parts, head and breast, and pale abdomen, but the latter is white in the miro and yellow of varying shades in the ngiru. The females are greyish-brown with white under-parts, but may be recognized by their movements and build, which are similar to those of the males. Both species live practically entirely on insects, but they exploit a quite different locus from the preceding species and a correspondingly dissimilar set of insects. A large portion of their food, as indicated in the article dealing with forest-birds, is obtained from the ground, whither frequent darts are made from a position of vantage, in which the black beady eye is constantly alert.

In winter both the miro and the ngiru occasionally frequent orchards and gardens; but the writers know of no recent cases where nests have been built in such situations. The same remarks apply therefore to the nests of these birds as were made on those of the yellowhead and its relatives.

THE NORTH ISLAND AND THE SOUTH ISLAND ROBINS.

With regard to the North Island and South Island robins (*Miro australis* Sparr.), so far as economic considerations are concerned, we are almost compelled, on account of their great scarcity, to speak in the past tense. It is one of the great mysteries of the disappearance of New Zealand indigenous birds that the miro and the ngiru should have survived in such considerable abundance, while the two robins, so like in haunts, habits, food, and nesting-sites, should have become extremely rare. The moral is clearly this: that the decrease of the indigenous birds is not a topic on which any person is competent to express an opinion, but a scientific problem to be studied with all the methods of modern research.

FIG. 2. NEST OF GROUND-LARK, OR PIPIT.

This nest was found on the Tararua Range at an elevation of 4,500 ft., and was built in the heart of a bush of astelia, the leaves of which show round the centre of the picture.

[*Photo by E. B. Levy.*

THE PIPIT, OR GROUND-LARK (*Austranthus novaseeelandiae* Gm.).

In an indefinite manner every one knows "larks," but whether every one appreciates the difference between the little pipit and the introduced skylark is another question. It is, moreover, of the first importance that people should discriminate between the two, since the former is a wholly beneficial bird, while the latter is perhaps the most injurious bird in New Zealand—one which should never have

been introduced and for which very little good can be said. The pipit, or pihoihoi, which, by the way, is not a true lark at all, may be distinguished by the very conspicuous white outer tail-feathers, especially noticeable in flight, by its much slenderer build and longer tail, the longer and slenderer bill, and, above all, by its familiar habit of rising from the ground just in front of one, flying a short distance and then alighting just ahead, where it walks briskly about uttering its cheerful note until the observer again approaches.

The nest, which is a much more substantial structure than that of the introduced skylark, is placed on the ground among the roughage of a pasture, in the drier portion of a swamp, or sheltered among the alpine herbage far above the bush-line on the mountain-side, as shown in Fig. 2. The eggs, as will be noticed, need never be confused with those of the skylark. They are often more rounded, but the chief distinguishing character is the heaviness and distinctness of the blotches of darker colour. In the skylark's egg these are smudged and less contrasted.

The food of the ground-lark consists almost entirely of insects and their larvæ, some of the former of which it often snaps up on the wing. Small earthworms and occasional minute seeds contribute to its bill of fare.

THE RIFLEMAN AND THE WRENS.

The last of the purely insectivorous birds to be dealt with are those small active short-tailed birds popularly known as "wrens." It should perhaps be mentioned that they are none of them true wrens, but members of a family or two families found nowhere else in the world. Of the three species still existing at the present day the rock-wren (*Xenicus gilviventris* Pelz.) bears no relation to agriculture, since it is confined to the wilderness of rock above the bush-line on the mountains of the South Island; the green wren (*X. longipes* Gm.), a very rare bird, renders some service to forestry in that it is an ever-active insect-hunter in the subalpine beech forests, where the ordinary forest-birds are quite rare. The rifleman (*Acanthisitta chloris* Sparr.), however, the smallest bird in New Zealand, occurs plentifully in beech forests in the North Island and throughout all forest in the South. It is easily recognized by its extremely small size, greenish colour, and slightly upturned awl-shaped bill, and by its habit of running in a very mouse-like manner up the trunks and large branches. The nest is placed in a crevice of bark or bank, or in a natural hole in tree or log. Frequently, when in living timber, the nest-entrance is so small that the tip of the forefinger can be inserted only by turning it sideways. Such was the case in the nest sketched and shown in Fig. 3. The nest itself is of the most irregular shape, and is suited to the exigencies of the selected cavity. The eggs are small and pure-white.

CONCLUSION (OF PART IV).

As was indicated in the opening article of this series, there are some birds which are beneficial, provided their numbers be not too great; with others a careful balance must be struck between the services they render and the damage they do. In the case of the insectivorous small birds dealt with in the preceding pages the only verdict must be one

of unqualified appreciation. The writers would stress that the annual loss to this country through the damage wrought by insect pests is estimated at several million pounds, and that unquestionably the

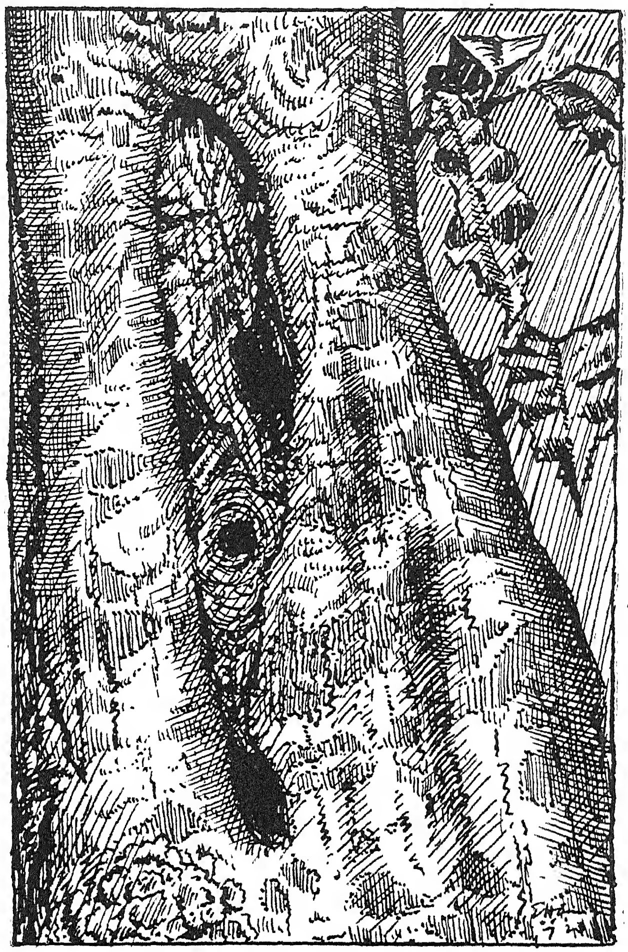


FIG. 3. NEST OF RIFLEMAN IN KAMAHI (WEINMANNIA RACEMOSA) TRUNK.

[*Drawing by E. H. Atkinson.*

greatest factor in the prevention of the increase of that damage to an extreme extent is the activity of bird-life, and particularly of such specialized insect-hunters as those just described.

REFERENCES.

BALFOUR, A. (1914): Birds and Malaria. Abstr. in *Rev. Appl. Entom.*, ser. B, vol. 3, p. 45, 1915.

BUCKLAND, J. (1915): The Value of Birds to Man. Abstr. in *Rev. Appl. Entom.*, ser. B, vol. 4, p. 2, 1916.

DUNSTAN, ALAN G. (1922): The Natural Control of the White-marked Tussock-moth under City and Forest Conditions. *Proc. Acadian Entom. Soc.*, No. 8, pp. 109–127.

FITZSIMMONS, F. W. (1917): Our Native Birds—their Value to Man. Abstr. in *Rev. Appl. Entom.*, ser. A, vol. 5, p. 354.

GODARD, A. (1917): Les Insectes Carnivores et la Vigne. Abstr. in *Rev. Appl. Entom.*, ser. A, vol. 5, p. 354.

PASQUALIS, L. (1915): Venezia e le Zanzare. Abstr. in *Rev. Appl. Entom.*, ser. B, vol. 3, p. 64.

THE ORGANIC MATTER OF THE SOIL.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THE various classes of material which go to make up a fertile soil may be broadly classified into five groups, according to the origin of each.

First there is the rock-derived mineral matter, wholly lifeless, but capable of change in composition, character, and appearance — compound reacting with compound, or with the soil-water, or with the substances dissolved in it. Second are the important salts of calcium, mostly derived from pre-existing life—the carbonates and phosphates of lime, as they are commonly called. Third is the soil-water or soil-solution, containing, in addition to a certain amount of carbonic-acid gas, small amounts of other soil-constituents. Fourth is the soil-air, about which so much remains to be learnt. Fifth, and most important, is that portion of the soil which will burn away when ignited, known as "organic matter," derived from the remains of plants and animals dying in or on the soil, forming ultimately a black spongy mass, the culture medium for nourishing that portion of the soil-life which lives wholly below the surface.

This organic matter, or, as it is often broadly termed, humus, is the portion which gives character to the soil, and when present in sufficient quantity obliterates all other distinctions. For instance, both sandy and clay soils when altered by the growth of organic matter lose their characteristic features, both loose porous and very dense impermeable soils, when mixed with organic matter, becoming altogether changed in texture. Thus on the Manawatu dune-sands, where the topography will not permit the escape of the copious surface water, aquatic and semi-aquatic vegetable growth develops, organic matter accumulates, and finally, in an area surrounded by sandhills and resting upon sand, occurs an area which when drained and "brought in" presents none of the difficulties of treatment which the sand (with which it may be still largely admixed) originally exhibited.

A good supply of organic matter darkens the colour of the soil, thereby causing the absorption of more sun's rays than is possible in a lighter-coloured soil. This effect in rise of temperature is appreciable, and may be measured by means of a thermometer. Organic matter can withdraw from the soil-solution various plant-foods. It causes the soil to swell up, thereby increasing its pore-space and

mitigating the evil effects of wet seasons on the growth of crops. By increasing the water-holding capacity of the soil in seasons of temporary drought it again benefits the growing plant. Organic matter is a source of energy. With it beneath the soil-surface life is possible to many kinds of visible and invisible plants and animals, some having a beneficent and some a maleficent effect on crop-growth, but the net result on crops must be for good. Organic matter assists the decay of rocks, and in soils of coarse texture fills up the large excess of air-space with colloidal (or gelatinous) vegetable matter, which has a decomposing effect on the mineral particles and renders the whole into a mellow loamy mass highly responsive to cultivation, liming, and artificial manuring, resisting abnormalities of climate—a fit home for the nurture of the seedling crop at its tenderest stage.

The importance of conserving the organic matter in a soil will be seen when the difficulty of replacement and the result, if this is not done, are considered. Usually everything that a soil requires may be purchased in commerce except organic matter. This must be either supplied on the farm or accumulated indirectly by an artificial system of fertilizing and liming, green-manuring, or by laying down in pasture. The history of many of the derelict farms of the United States of America is that of neglect in conserving and replacing organic matter. The rehabilitation of these farms is dependent on giving back those soil-constituents which have been squandered by wasteful and continuous methods of cropping. The replacement of the mineral nutrients removed by crops or washed away in the drainage-water may be accomplished at any time artificially, but the recovery of the nitrogenized organic matter is a much slower process, involving the abandonment of all tillage operations and leaving the soil to be covered by vegetation for a number of years. So by the aid of life the gases of the atmosphere—carbon dioxide, nitrogen, and oxygen—and water are slowly built up into life-giving humus.

Chinese market-gardeners—oldest of husbandmen—know the advantages of organic matter, and not only endeavour by manuring with decomposable materials to maintain a state of high fertility, but in the first place take care to select the site of old swamps black with decayed vegetation as the situation of their gardens.

The organic matter of the soil consists of material in all stages of decomposition, from material which shows organized structure (even the kind of plant which yielded it can be made out in some swamps) to the spongy black material in which all visible traces of organic structure have been lost. The change goes further still, for the oxidation of the humified mass continues towards the stage at which it is resolved into those gases and water whence the organic matter was originally derived.

Among the factors in nature which bring about an accumulation of organic matter are low temperature, excessive water, and limestone. In the subantarctic islands southward of New Zealand a humus soil accumulates as it does in the northern islands of Britain, even in situations where there should be good drainage. One would think that the low temperature would be the main factor in our southern islands, though the absence of bacteria may contribute to the result. In the warmer North Island of the mainland, where peaty soils develop, one

would think that it is the stagnant water and lack of oxygen which determines the accumulation; while in situations where limestone comes near the surface in dry, warm districts one finds a deposit of mellow black soil accumulating which can be due neither to cold nor excessive moisture, nor to lack of oxygen.

In certain areas where swampy soils containing much organic matter have developed and are deficient in mineral matter it may be practicable to transport inorganic or mineral matter, such as sand and pumice or clay, on to the surface, and so improve the soil in its deficiency. Nature has done this for the extensive Te Puke and Rangitaiki Swamps. Layers of air-borne pumice and volcanic ash are to be found at various levels in the former, and calcareous mud, pumice, and ash layers in the latter swamp. These layers greatly facilitate drainage, and ameliorate the conditions physically and chemically to a degree which owners of other swamp lands can only envy. When one reflects on the good which a pumice deposit will effect on a swamp soil it at once suggests what should be supplied to a pumice soil to improve it.

It must not be thought, however, that humus soils are everything that could be desired, for even they have their weaknesses. Frequently they are deficient in mineral plant-food, but respond at once to dressings of phosphates or potash when these are lacking. Sir John Russell, F.R.S., quotes a pathetic instance of an American farmer who endeavoured to farm on a black soil. "The land looked rich," he said, "as rich as any land I ever saw. I bought it, drained it, and built my home on a sandy knoll." His first crops were fair, but grew rapidly worse. He and his wife and children wasted twenty years of their lives on this land. It was poverty, poverty always. After he had given up his holding, and a chemist had been at work on the problem, the farmer one day brought his wife and children to see the heavy crops on plots treated with potassic fertilizers alongside the miserable ones on untreated land. In tears he asked, "How was I to know that this single substance which you call potassium was all we needed to make this land productive and valuable?" In the case of humus soils mechanical analysis is inapplicable, so that any knowledge, apart from field and pot experiments, must be gained by chemical analysis.

The importance of increasing the store of organic matter or humus in New Zealand soils has not in the past received that attention merited by the importance of this aspect of manuring. There are three ways in which the organic matter in the soil may be increased in farming practice: (1) By applying dung, stable, farmyard, or other crude refuse of an approved organic nature to the soil; (2) by growing and turning in a green crop, known as "green-manuring"; (3) by putting the land down in pasture, which allows organic matter to accumulate. The difficulties of supplementing the store of organic matter in the soil are sufficiently indicated by these methods of redress, but the problem must be faced if many of the coarser-grained soils of this country are to be profitably and continuously worked.

At Stanley Brook Valley, Nelson, there is a flat area of gravelly loam and sandy silt concerning which the writer advised the local branch of the Farmers' Union in March, 1919, that "the improvement of these soils will depend largely on increasing the organic matter in

the soil, which may be accomplished either by ploughing in green crops (green-manuring), or growing a larger share of clovers and other leguminous plants in the pasture, or, where possible, by applying organic manures, stable manures, or flax-waste refuse, and generally adopting methods of farming which will conserve the organic matter in the soil." The Cawthron Institute's chemist, Mr. T. Rigg, has recently pointed out as a result of his investigation of this land that "every effort should be made to maintain the humus content of the soil. This may be effected by periodical ploughing-in of catch-crops of blue lupins or tares with oats. The latter crop is particularly recommended."

The pumice gravels and coarse sands of the North Island thermal district show similar improvement, and largely lose their identity as coarse soils when they have been submerged by lake or river, mixed with the remains of aquatic plants, and have finally emerged as a terrace highly fertile in comparison with the material as it existed in its original state, and still exists in many parts where the beneficial influence of lake or river has not been felt.

Attempts to improve coarse pumice lands should be based upon the methods seen to be successful in nature, but hastened to accord with present needs. In forested areas which have been cleared top-dressing methods must suffice until the stumps can be profitably removed, but in areas growing scrub green-manuring and rolling could at least be tried experimentally. In areas suffering from exceptionally severe climatic conditions the planting of exotic forest will mitigate the severity of the cold and add organic matter to a soil greatly in need of it. (A discussion on pumice soils may be found in the *Journal*, vol. 4, 1912, page 374.)

CONCLUSION.

It is thus seen that organic matter improves the texture of all soils deficient in that constituent, whether they are, on the one hand, extremely loose and porous, or, on the other hand, stiff, impermeable, and tenacious. However rich a soil may be in mineral plant-food, if it lacks the texture conferred by an adequate supply of organic matter there will be trouble in abnormal seasons; while for a large number of soils of coarse texture and deficient water-holding power it is essential that prompt attention should be paid to the organic-matter content if fertility is to be maintained. Organic matter tends to accumulate in land under permanent pasture, and to diminish in land under crop.

List of Qualified Veterinary Surgeons.—The name of Mr. A. Taylor, F.R.C.V.S., was omitted from the list published in the June *Journal.* Mr. Taylor recently retired from the staff of the Canterbury Agricultural College, Lincoln, and is now located at Christchurch.

The Gold Medal of the Linnean Society (London) has this year been awarded to Mr. T. F. Cheeseman, of Auckland, author of the "Manual of the New Zealand Flora."

TESTING OF NEW-ZEALAND-GROWN WHEATS.

II. STRENGTH OR QUALITY OF FLOUR.

L. D. FOSTER, Analyst, Chemistry Section, Wellington.

THE best wheat is that one which will produce the greatest amount of flour of the best quality. In the previous article, printed in last month's *Journal*, the amounts of flour obtained from wheats grown in various localities in New Zealand were considered. Yield of wheat per acre and yield of flour are indeed important considerations; the miller, however, has to supply the market with a product of as good quality as possible. He judges a flour largely by colour, strength, and weight of flour per bushel of wheat. By blending the very best wheats with more average samples he endeavours to maintain a satisfactorily high standard, and one which satisfies the requirements of the baker and the consumer. Since it is the quality or strength of the flour which really determines the demand and the value of a wheat, this factor of strength is no less important than those other considerations. A strong wheat has been defined as one which yields flour capable of making well-piled loaves.

The strength of flour, then, is its apparent and potential ability to produce a large loaf of good texture: a hard wheat will generally produce a strong flour, a soft wheat a weak one. It is a well-known fact that if the starch is carefully washed away from flour a curious plastic elastic mass remains. This is the so-called gluten, which is a mixture of two nitrogenous chemical compounds, gliadin and glutenin. Gluten imprisons gas generated by the fermentative processes due to the addition of yeast, and in this way enables a loaf to retain, after baking, that texture so characteristic of well-baked bread. Many attempts have been made to correlate strength with any one constituent as determined by chemical analysis. For many years discussion of strength centred on whether the protein (or gluten) content of a flour was or was not a true indication of this quality. Proteins, it will be remembered, are a group of compounds present in plant (and animal) tissues, easily assimilated by the body and contributing to the formation of muscle, &c. It was at first thought that the amount of gluten (which is very closely related to the total amount of protein) was the controlling factor; then the idea became general that the quality of the gluten was all-important and the quantity rather negligible. Many other factors which at first sight have appeared rather contradictory have been considered at length, and in the light of fuller knowledge found often to be supplementary in character rather than otherwise. It is true that much remains to be done; at the same time it is likely that the truth lies between many divergent statements of fact and of theory. Stockham (1) thinks that the total quantity of gluten present is important, and that a consideration of quantity no less than quality is essential to an understanding of strength. In applying the statistical method Zinn (2) has compiled a large amount of published data on the

chemistry of wheat, and computed the coefficients of correlation for the important chemical characters; he has shown that there is a very close connection between quality, quantity, and amount of gluten present.

Another method of arriving at the strength of flour is to determine the amount of water retained by the gluten extracted from any sample (3). In New South Wales the proportion of water taken up by the flour itself has been regarded as a good indication of strength (4). Lastly, the percentage of ash serves, among other things, as an indication of the skill of the miller (5 and 6).

These methods may not apply equally to wheats grown under New Zealand conditions. But even if no single property is an unfailing measure of strength, it is probable that from a consideration of several a very good idea of the quality may be obtained. Only by further investigation of varieties grown under local conditions, and collection of data obtained from them, will more information be obtained.

It was pointed out in the previous article that the cause of strength, or lack of it, is due to three main factors—climate, soil-fertility, and variety. Fertility, of course, affects yield of wheat, but apparently not strength of flour (7 and 8). There remains the varietal factor, and there is no doubt that strength may often be improved by proper selection and breeding.

EXPERIMENTAL WORK.

Some sixty-six samples were milled in this Laboratory, and further examination was made as to the probable strengths of the resulting flours. A selection of the results obtained is tabulated in the accompanying Table II.

It is to be regretted that only a few samples of Pearl were received. It will be remembered that this variety gave as a rule a very good yield of flour. Referring to Table II, it will be seen that the sample with the lowest percentage of flour (P 305) contained the most valuable amount of protein; but the other three samples—which, on the other hand, all yielded very good amounts of flour—were all very close in protein content to the highest. The amount of water absorbed per cent. of flour reached a good average in these samples. It will be seen that the amount of dry gluten was approximately the amount of total protein present; the ratios of wet to dry gluten showed considerable divergence, but in view of the small number of samples received nothing further can be said on these figures.

A more satisfactory number of samples of Velvet was received. The sample giving the second highest yield of flour (P 294) also contained 15·75 per cent. of protein, which is a remarkably good figure. Its water-absorption figure was also high, and the ratio of wet to dry gluten was satisfactory. This wheat—from Dumbarton,* near Roxburgh—appears to be a wheat of all-round excellence. It is followed closely by three samples which also showed very good protein content. Of these three it appeared that the lowest in protein

* This and all other samples from Dumbarton were grown at the Moa Seed Farm.

TABLE II.—TESTS FOR STRENGTH OR QUALITY OF FLOUR OF NEW-ZEALAND-GROWN WHEATS (SELECTED RESULTS).

Laboratory No.	Variety.	Locality and County.	Flour.	Moisture.	Absorption of Water.	Gluten, Wet.	Gluten, Dry.	Ratio of Wet to Dry Gluten.	Nitrogen.	Protein.	Ash.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
P 305	Pearl ..	Balcairn, Kowai	71·0	12·92	51·6	27·22	9·74	2·79 : 1	1·60	10·00	0·48
O 811	,, ..	Lincoln, Springs	73·8	12·98	54·4	26·94	9·51	2·83 : 1	1·58	9·88	0·48
P 382	,, ..	Frankton, Lake	74·3	13·53	56·0	24·05	8·89	2·71 : 1	1·54	9·63	0·58
P 307	,, ..	Weedon's, Paparua ..	75·2	12·83	53·0	31·35	10·12	3·10 : 1	1·54	9·63	0·60
P 294	Velvet ..	Dumbarton, Tuapeka ..	74·1	13·40	57·5	45·70	15·84	2·88 : 1	2·52	15·75	0·67
P 291	,, ..	Middlemarch, Upper Taieri	72·6	13·50	57·4	45·00	15·65	2·88 : 1	2·38	14·88	0·54
P 290	,, ..	,, ,,	71·8	13·67	57·0	39·73	13·82	2·87 : 1	2·11	13·19	0·56
P 262	,, ..	Windsor Downs, Waitaki ..	73·1	12·87	58·6	42·78	14·06	3·04 : 1	2·04	12·78	0·65
P 292	,, ..	Nenthorn, Upper Taieri ..	72·9	13·62	57·8	34·13	11·41	2·99 : 1	1·81	11·31	0·54
O 814	,, ..	Lincoln, Springs ..	70·8	12·89	56·0	28·85	10·52	2·74 : 1	1·69	10·56	0·51
O 812	,, ..	,, ,, ..	75·2	12·80	57·0	30·65	10·74	2·85 : 1	1·61	10·06	0·59
P 308	College Hunters	Doyleston, Ellesmere ..	71·5	12·73	52·2	33·57	12·77	2·63 : 1	1·95	12·19	0·56
P 295	,,	Dumbarton, Tuapeka ..	73·6	13·79	54·0	32·31	11·15	2·90 : 1	1·75	10·94	0·69
P 313	,,	Lincoln, Springs ..	71·7	13·09	50·4	34·93	11·68	2·99 : 1	1·74	10·88	0·56
P 265	,,	Airedale, Waitaki ..	73·0	13·18	52·4	27·73	9·65	2·87 : 1	1·53	9·54	0·63
P 383	Tuscan ..	Malaghan's, Lake ..	72·6	13·80	53·4	32·13	11·09	2·90 : 1	1·78	11·13	0·60
P 201	White Tuscan ..	Tuamarina, Marlborough	70·4	13·34	51·4	30·21	10·44	2·89 : 1	1·64	10·25	0·59
P 467	,, ..	Winton, Southland ..	71·5	13·78	52·4	25·02	9·02	2·77 : 1	1·58	9·88	0·72
P 317	Solid-straw Tuscan	Horrelville, Eyre ..	71·1	12·94	53·0	28·02	10·59	2·65 : 1	1·57	9·81	0·58
P 416	Ditto ..	Carterton, Wairarapa S. ..	70·5	14·69	51·8	29·37	10·30	2·85 : 1	1·53	9·54	0·60
P 256	Purple-straw Tuscan	Windsor, Avon	71·3	12·93	53·6	29·16	10·46	2·80 : 1	1·67	10·41	0·62
P 322	Victor ..	Domett, Cheviot ..	74·4	13·04	50·2	24·53	8·39	2·92 : 1	1·54	9·63	0·56
		Miscellaneous.									
O 815	Burbank's Super	Flaxton, Eyre	70·0	12·96	57·2	41·10	14·85	2·77 : 1	2·31	14·44	0·50
P 431	Huron ..	Dumbarton, Tuapeka ..	74·9	13·67	51·6	31·84	11·58	2·75 : 1	2·03	12·69	0·74
P 432	Thew ..	,, ,, ..	71·1	13·45	54·2	35·61	12·52	2·84 : 1	2·00	12·50	0·68
P 430	Rymer ..	,, ,, ..	70·4	13·51	53·2	29·88	10·63	2·81 : 1	1·96	12·25	0·61
P 429	Marquis ..	,, ,, ..	72·4	13·54	56·2	30·65	11·44	2·68 : 1	1·84	11·44	0·69
P 466	John Brown ..	Winton, Southland ..	70·0	13·86	53·2	31·76	11·53	2·76 : 1	1·81	11·31	0·66
P 260	Dreadnought ..	Kurow, Waitaki	75·0	12·77	51·0	33·82	11·38	2·97 : 1	1·67	10·41	0·57
P 259	,, ..	Kia Ora, Waitaki ..	73·1	13·10	49·8	35·60	12·00	2·97 : 1	1·75	10·94	0·64

was probably the best all-round wheat, a conclusion that was arrived at from a consideration not only of the protein present, but also of its very good milling-properties. Its capacity for water was also higher than that of the other two. All three, however, were very good wheats. The three remaining samples were fairly good wheats and better than the average; O 814, however, was rather low in its milling-properties. Velvet, then, in 1922, was an all-round good variety. The absorption-of-water figure was always high, a fact of much interest and importance to the baker. This variety also gave a good average yield of flour per bushel. Lastly—and this is always important—the average protein content was good, and, when grown in some localities, excellent. In this respect it is interesting to note the very good sample of wheat from Dumbarton, and the high average of the three samples from the Upper Taieri, districts near the borders of the area of lowest rainfall in New Zealand. As a variety, Velvet would be classified in Australia as a "medium strong" wheat. There is no doubt that at least four individual samples among those now under discussion might with justification be classified as "strong" wheats.

Three samples of College Hunters were good wheats, and might be called medium strong; the fourth was a medium wheat with 9·54 per cent. protein. The best of these was from Dumbarton, with a yield of 73·6 per cent. flour, and containing 10·94 per cent. protein; its capacity for water and the ratio of wet to dry gluten were both good.

The best of three samples labelled Tuscan came from Malaghan's, Lake County, part of which is the driest district in the Dominion; this wheat milled well, with 72·6 flour, possessed a fair capacity for water, and contained a good amount of protein—quite a good all-round wheat. Two samples of White Tuscan and two samples of Solid-straw Tuscan contained moderate amounts of protein. A Purple-straw Tuscan was rather better in this respect. It will be remembered that the samples of Victor gave generally very good yields of flour. In 1922, however, they appeared in most cases to be lacking in strength, but P 322, from Domett, Cheviot, was a sample above the average for this variety.

The "Miscellaneous" samples gave some interesting results. It is true that usually only one sample of each was received; nevertheless the information obtained is sufficient to warrant further investigation of these lesser-grown varieties. One of the outstanding samples milled in 1922 was the Burbank's Super, grown at Flaxton, Eyre. It is said that this variety compares favourably with other wheats in yield per acre, and that its chief characteristic is early maturity. This particular sample milled rather poorly, with 70 per cent. of flour; but it more than made up for this deficiency by its protein content, which was as high as 14·44 per cent. This is nearly 1 per cent. higher than the average of the strong red wheats exhibited during recent years at the New South Wales Royal Agricultural Society's show at Sydney (9). The absorption figure was very good, and, although the ratio of wet to dry gluten was unexpected, it was observed that the physical condition of the extracted gluten was better than is usually the case. One cannot, of course, judge a variety by one sample, but the figures undoubtedly show that the adaptability of the variety to local conditions is well worth looking into.

From a sample of Huron (apparently a Canadian wheat), grown near Dumbarton, results as interesting as those of Burbank's Super were obtained. Its milling-yield (74·9 per cent. flour) was very good, and, in addition, its protein content reached the high figure of 12·69 per cent. This is an excellent strong sample.

A sample of Thew, also from Dumbarton, milled moderately well, and contained a very good amount of protein (12·50 per cent.); it had a fair capacity for water, and the ratio of wet to dry gluten was satisfactory. It might be classified as a medium-strong wheat. In the same class might be placed the sample of Rymer (grown at the same place), which is a rather poor milling-wheat but one of good strength (12·25 per cent. protein); it is also classified in New South Wales as of medium strength.

Marquis, originally a Canadian variety, is now extensively grown in Australia, where it is classified as a strong red wheat; in certain American States it fetches highest prices (10). The one sample tested here hardly maintains that high level, but its milling-yield is good, and it still contains a good percentage of protein.

John Brown, from Winton, yielded only 70 per cent. of flour, but it possessed a good amount of protein, and appears to be a medium-strong wheat. It is interesting as being a Farrer cross, which in Canada has the reputation of being a strong wheat with a good average yield per acre, and giving better all-round results than many Canadian varieties.

Two good all-round samples are those of Dreadnought, grown in Waitaki County. Both gave very good milling-yields, and both contain good percentages of protein, being medium-strong wheats well above the average.

VARIETIES AND LOCALITIES.

In grouping the 1922 samples into districts it must be remembered that at present, because of lack of sufficient data, no general comparison between varieties is possible. In a few cases, however, the results do seem to point to one or two outstanding characteristics which should be noted.

Nine samples were received from the drier parts of the Tuapeka-Upper Taieri districts. Here the very well defined good quality of these wheats and the high average which they maintain are clearly apparent. Not only are they good milling samples, but five appear to be strong wheats, while four of them are medium-strong samples. Some of them are not widely known in New Zealand, and only further experiment will show if they can maintain this standard. It is probably no coincidence that three samples of Velvet occupy prominent positions among this collection of strong wheats.

The Waitaki wheats contained medium-strong samples of Dreadnought. Of the others, one was a Velvet with a very good milling figure of 73·1 per cent. flour, and containing a very good amount of protein, 12·78 per cent. This could be considered a hard wheat, giving a flour of very good strength. Among the others a fair average was maintained.

From Springs County six samples were received, of which two, a College Hunters and a Velvet sample, were good medium-strong

wheats; samples of Velvet (P 812) and Pearl (P 811) were average samples. A sample of College Hunters from Ellesmere was a good wheat, with 12·19 per cent. protein. Lastly, from Eyre came the excellent sample of Burbank's Super, referred to at length in a previous paragraph.

SUMMARY AND CONCLUSION.

Wheats may be classified into (*a*) strong, (*b*) medium-strong, and (*c*) weak samples.

On examining Table II it will be found that in 1922 one variety, Velvet, stands out as being generally the best wheat grown in its district. In particular, when grown in the drier parts of Tuapeka and Upper Taieri districts bordering on the area of lowest rainfall in New Zealand, three samples of Velvet are conspicuous even among strong wheats. Varieties which, although represented often by single samples, give promise of being wheats of good strength are Burbank's Super, Thew, and Huron. Others which appeared to be good medium-strong wheats are John Brown, Dreadnought, Marquis, and Rymer.

It is apparent that variety has a considerable influence on strength. Some varieties maintain a relatively high standard under different environments; such a variety is Velvet. Others show a fairly large range in protein content, some samples containing high percentages of protein; but the average for such a variety may often be low. In such a case, notwithstanding these better exceptions, the variety as a whole must be regarded as a soft wheat. Only in special cases, such as suitability of climate and soil favouring production of the better samples of the variety, should such a wheat be grown—from the milling and breadmaking points of view.

Another important factor is that of climate, samples from some districts showing to distinct advantage. It will be noticed that the drier districts in general produce stronger wheats. To a marked degree this is true of Central Otago, a notably arid district, as evidenced by the samples from Tuapeka and Upper Taieri. This is what one would expect from data published in other countries where it has been observed that comparatively high temperatures, long days, and absence of excessive moisture during ripening, hasten maturation of the grain and increase its content of gluten, and hence its protein (8 and 11). There are probably other districts in the Dominion with characteristic climates which the examination of further samples will prove also to be specially adapted to the growing of strong wheats.

It is probable that no one variety possesses combined the desired characteristics of yield per acre, protein content, flour-yield, weight per bushel, and the required milling-qualities. Evidence may be obtained, however, by experimental milling and chemical investigation, indicating which varieties combine most of these qualities and are therefore most profitable to grow or to use for selection.

Finally, although individual samples may often be regarded as possessing the elusive quality of strength to a marked degree, a variety may be classified as a strong or medium-strong wheat only from data obtained from many individual samples and extending over a period of years.

REFERENCES IN TEXT.

(1.) STOCKHAM, W. L.: Some Factors related to the Quality of Wheat and Strength of Flour. *Bulletin 139, North Dakota Exp. Station*, 1920.

(2.) ZINN, J.: Correlations between various Characters of Wheat and Flour. *Journal of Agricultural Research*, 1923, p. 529.

(3.) *International Review of the Science and Practice of Agriculture*, Rome, 1922, p. 1331.

(4.) GUTHRIE, F. B.: Wheat and Flour Investigation. *Science Bulletin No. 7*, Department of Agriculture, New South Wales, 1912.

(5.) JAGO, W.: The Technology of Breadmaking, p. 307.

(6.) SNYDER, H.: *Bulletin No. 85, Agric. Exp. Station, Minnesota*, 1904.

(7.) HUMPHRIES, A. E., and BIFFEN, R. H.: The Improvement of English Wheat. *Journal of Agricultural Science, Cambridge*, 1912, p. 1.

(8.) SHUTT, F. T.: Influence of Environment on the Composition of Wheat. *Journal of the Society of Chemical Industry*, 1909, p. 336.

(9.) *Agricultural Gazette of New South Wales*, 1918, 1919, 1920, and 1921.

(10.) *Experimental Station Record*, 1922, pp. 131, 337.

(11.) ROBERTS, H. F.: The Relation of Protein Content to Variety Types. *Journal of Agricultural Science*, Cambridge, 1920, p. 121.

BLACK-ROT (PHYSALOSPORA CYDONIAE ARNAUD).*

A FUNGOUS DISEASE OF APPLE, PEAR, AND QUINCE.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

THIS disease has been recorded from North America, Australia, and Europe. In certain parts of North America it is considered as a serious parasite of the apple, second in importance only to black-spot, but in Europe and New Zealand it is comparatively a minor disease. In New Zealand it is a common canker of apple and pear, and in North America it has been recorded on many additional hosts, among which may be enumerated elder, hawthorn, lilac, mulberry, oak, and rose. In our earlier reports cankers caused by it were attributed to European canker, *Nectria galligena* Bres., but fortunately this fungus is not known to occur in New Zealand.

APPEARANCE AND EFFECT ON THE HOSTS.

Black-rot infects shoots and branches, fruits, and leaves. On the laterals and branches, but more frequently on the latter, it forms definite cankers. These at first appear as small elliptical areas, noticeable on account of their colour differing from that of the healthy bark. Shortly after its formation the cankered area becomes separated from the normal bark by a crevice. Then the diseased bark shrinks so that the canker appears slightly sunken (Fig. 1). Usually the healthy bark at the margin of the canker becomes slightly raised, due to the development of corky tissue in this region. The diseased area then

* Synonyms: *Sphaeropsis malorum* Berk.; black-rot canker; black-rot leaf-spot; body-blight; body-canker; frog-eye; fruit-spot; New York apple-tree canker; ring-rot.

becomes lighter in colour, and consequently more conspicuous. Growth of the fungus proceeds in a radiate manner, so that invariably in old cankers there are present numerous crevices, arranged in zones, which have been formed as successive layers around the canker. These render the canker conspicuous and readily discernible; further, they serve as quite a good character to separate black-rot cankers from those formed by other diseases (Fig. 2). Cankers may continue

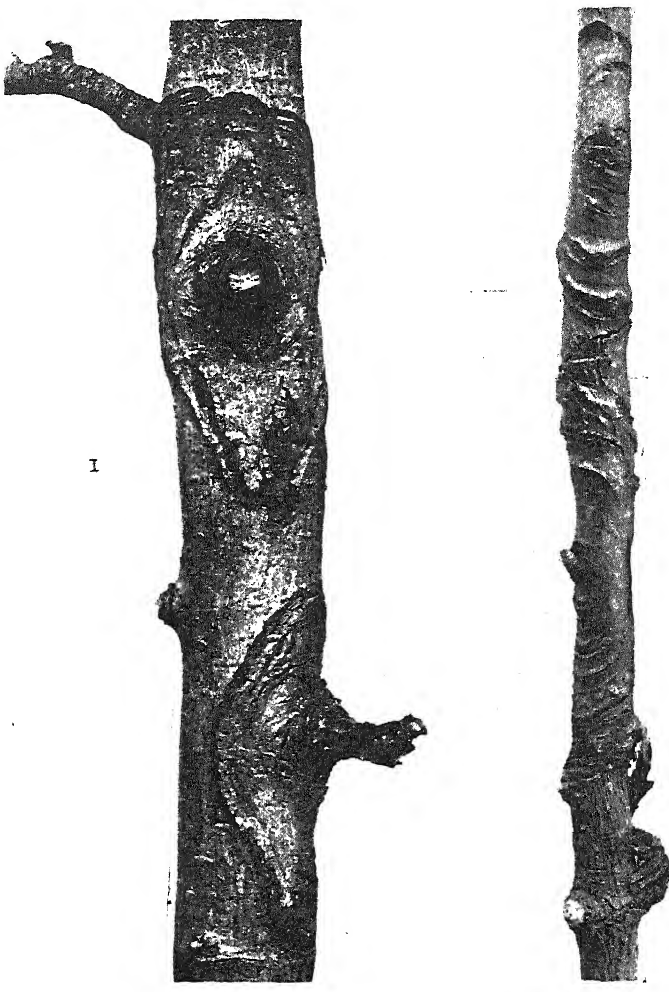


FIG. 1. BLACK-ROT CANKERS ON PEAR-BRANCH: POINT OF ENTRY THROUGH DEAD FRUIT-SPUR. NATURAL SIZE.

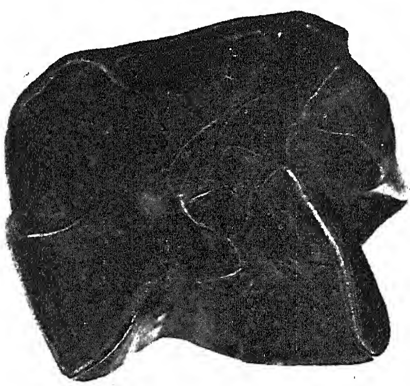
[*Photo by W. D. Reid.*

FIG. 2. BLACK-ROT CANKER ON ONE-YEAR LATERAL OF PEAR: POINT OF ENTRY THROUGH DEAD LEAF-BUDS. NATURAL SIZE.

Note the concentric cracks characteristic of black-rot canker.

[*Photo by G. H. Cunningham.*

3



4

FIG. 3. DUNN'S FAVOURITE APPLE AFFECTED WITH BLACK-ROT. NATURAL SIZE.
FIG. 4. OLDER CONDITION OF FIG. 3: TYPICAL MUMMIFIED CONDITION. NATURAL SIZE.

[*Photos by G. H. Cunningham.*

to grow for several seasons, or until the branch is ring-barked, when the portions above die. Death is often preceded by a gradual yellowing of the leaves, which usually fall prematurely. The bark sometimes falls away from old cankers and exposes the wood.

Sections through a canker on a medium-sized limb show that the sap-wood is discoloured for some distance beyond the visible point of infection, and microscopic examination reveals the presence of hyphæ of the fungus in this discoloured area. On large limbs girdling may not occur, the fungus in such a case forming large irregular cankers,

which may attain a length of 1 ft. or more. Some time after a canker has been formed fructifications of the fungus appear on the surface of the killed area.

Spots become noticeable on the leaves shortly after they emerge from the bud, and infection may occur during the whole of the growing season should conditions become favourable. At first the spots are minute, circular, scattered, and dark purple in colour. They soon increase in size, growth proceeding in a radiate manner, so that the centre portion (the original spot) may appear surrounded by definite zones. Later this central portion changes to greyish-brown, and as the surrounding zones are darker, these spots present a characteristic appearance, which has led to the name "frog-eye" being applied to them. Finally, spots may lose their circular outline and become lobed and irregular in shape. In cases of severe infection the spots may become so numerous as to coalesce, forming irregular dead areas on the leaf. Severe infection may be followed by defoliation.

Fruit-infection is followed by the appearance on the surface of small circular brown areas; these rapidly increase in size until the whole fruit becomes rotted. As these areas enlarge, zoning may occur, as in the case of leaf-infection, but this is not a common manifestation of the disease. Infected fruits do not become soft, but remain firm and spongy. Finally, the colour changes to jet-black, and the fruit gradually shrivels and becomes mummified (Fig. 3).

ECONOMIC IMPORTANCE.

Although in certain parts of the United States black-rot is a serious disease, causing an annual loss of several hundred thousand dollars, in New Zealand it is of minor importance, its chief damage being due to the cankers it forms on the branches of apple and pear trees. On leaves its effects with us are so slight as to be negligible, and on fruits it has little effect, as it appears to be confined to those which have been injured by codlin-moth or damaged during picking or packing. During the recent fireblight campaign in the Auckland District many hundreds of cankers were forwarded to this Laboratory, and in nearly every instance these were found to be caused by fireblight, black-rot, or macrophoma-canker. In most cases it was found that the source of infection of black-rot was through some bark-injury, such as is caused by branches rubbing together, or abrasions caused by woolly aphis.

LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

Black-rot is caused by the fungus *Physalospora Cydoniae* Arnaud,* an ascomycete having two spore stages in its life-cycle. The first or pycnidial stage, commonly known as *Sphaeropsis malorum*, is the parasite, the second or ascomycetous stage being saprophytic, as it appears in the dead bark of old cankers. In North America this stage

* Considerable doubt exists in mycological literature as to the proper name that should be applied to this species. For Shear (1914) claimed that ascospores of *Melanops Quercuum* Rehm. forma *Vitis* Sacc. produced in pure cultures pycnidia and spores morphologically identical with *Sphaeropsis malorum* Berk.,

appears to be rare, but in New Zealand it is quite common in cankers that are more than two years old. This fungus is a wound parasite, for it is apparently able to infect fruits and branches only through some injury of the epidermis or bark; but under certain conditions it is a true parasite, for in America it has frequently been demonstrated, by experiments in which spores (conidia) have been sprayed on to leaves, that the hyphæ of the fungus are able to penetrate directly through the epidermis into the underlying tissues.

Spores discharged in the early spring from fructifications embedded in the dead bark of cankers and the epidermis of mummified fruits are carried by wind or other agency to leaves and injured surfaces of branches, where if moisture conditions are suitable they germinate and produce a germ-tube (hypha). This penetrates into the tissues and there branches repeatedly, the hyphæ growing between the cells and absorbing from them the food substances necessary for their continued existence. As a result the host cells are killed, and turn brown. At this stage the hyphæ are colourless, but after a time they become dark-coloured, and it is these black masses of hyphæ that give the characteristic colour to infected fruits. After a time masses of hyphæ immediately beneath the dead epidermis become aggregated into little knots, which eventually develop into spore-bearing receptacles or pycnidia. These are flask-shaped or globose (Fig. 5), and contain numerous one-celled olive-coloured spores (Fig. 5, *d*, conidia†), which are borne on slender stalks (Fig. 5, *c*, conidiophores) produced from the inner surfaces of the lower portion of the pycnidia. The apices of the pycnidia at maturity pierce the epidermis; each is perforated by a small opening (ostiolum) through which the spores escape. The spores are embedded in mucilage, and as this readily absorbs moisture the spores are forced out through the opening by the swelling of the mucilage, when they appear on the surface in olive-coloured tendrils. The mucilage is dissolved away by rain, and the spores are released, when they may be washed by rain on to lower leaves and branches, or else carried by wind and insects to adjoining trees.

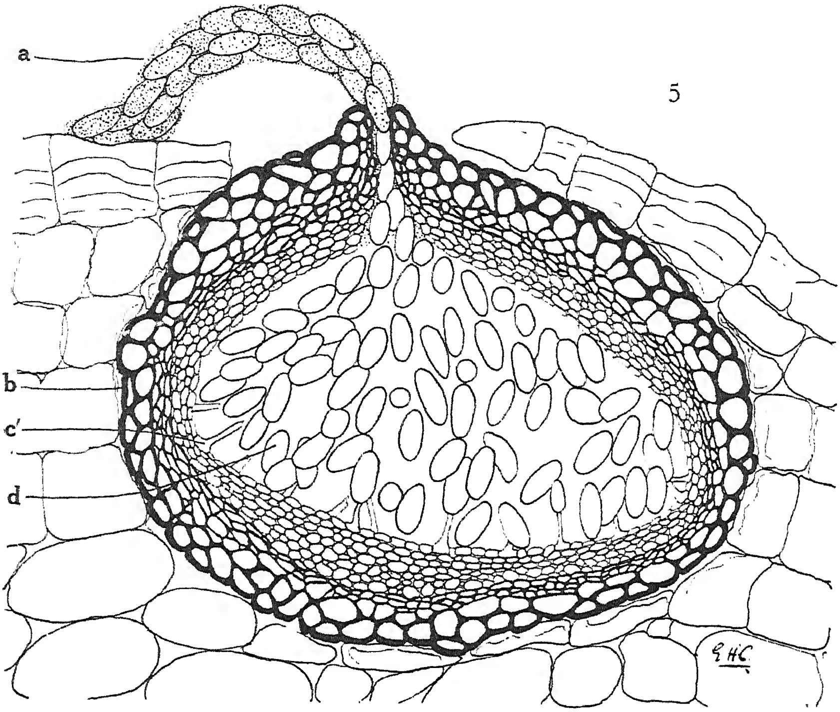
If a canker lives for more than one season, and the killed bark persists, the second or ascigerous form may appear. This consists of a flask-shaped perithecium containing numerous asci in which colourless one-celled spores are borne (Fig. 6).

These spores may be discharged on to the surface and carried to adjacent trees, where they are probably able to infect leaves and branches, and produce hyphæ, which in turn give rise to pycnidia.

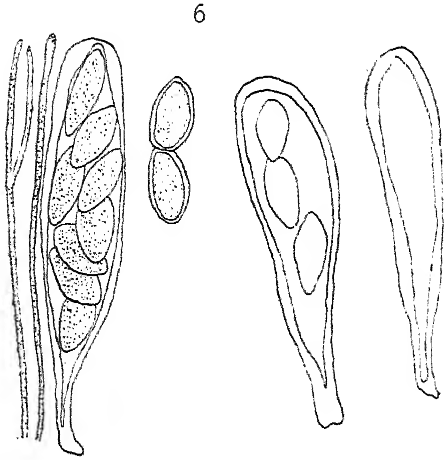
whereas Hesler (1913), after carrying out similar experiments with ascospores of *Physalospora Cydoniae* Arnaud, also obtained *Sphaeropsis malorum*. Hesler was able to infect apple-branches with ascospore material and produce typical black-rot cankers. On account of this, and the fact that the New Zealand ascigerous material agrees closely with his descriptions and figures, the name he used has been adopted. Our species obviously belongs to the Pleosporaceae, and not to the Melogrammataceae, so that Shear's claim would appear to be untenable in so far as the New Zealand organism is concerned.

† These spores are more correctly termed "pycnidiospores" or "pycnospores," as they are borne in pycnidia; but to save unnecessary use of terms they will in this and subsequent articles be termed "conidia."

5



6



7

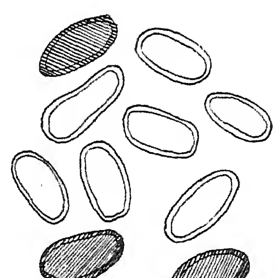


FIG. 5. SECTION THROUGH PYCNIDIUM (NOT QUITE MEDIAN).

(*a*) Spore tendril; (*b*) wall of pycnidium; (*c*) conidiophore; (*d*) conidia. × 150.

FIG. 6. ASCI, SPORES, AND PARAPHYSES OF BLACK-ROT ORGANISM. × 250.

FIG. 7. CONIDIA. × 250.

[*Original*.

Conidia are apparently able to remain viable for a considerable time, for in this Laboratory the writer has been able to infect apple-fruits with conidia taken from pear-cankers which have been kept in the herbarium for over twelve months.

REMEDIAL TREATMENT.

As the mycelium of this fungus may remain alive in a canker for several seasons, and during the growing-period is capable of producing fructifications (pycnidia) bearing spores, it would appear that these cankers are the means by which the fungus is able to carry over from season to season. This is borne out by American experience, for there it has been observed that early in the season, in the vicinity of viable cankers, leaf-infection commences shortly after the leaves emerge from the buds. Furthermore, American workers have recorded the fact that infection may commence from mummified black-rot fruits remaining on the trees, for they have frequently observed leaf-infection to commence in the vicinity of these fruits. On spots on living leaves spore-production is so uncommon that it is probable leaf-infection occurs throughout the season from spores produced from pycnidia in cankers and mummified fruits. Fructifications are commonly produced on leaves that have fallen to the ground, so fallen leaves that have escaped desiccation during the winter months are in all probability a source of infection the following spring.

Doubtless in New Zealand black-rot is held in check somewhat by spray treatment, but not entirely, for it appears to be about equally common in sprayed and unsprayed orchards. Such being the case, the eradication of the sources of infection would appear to be the only effective treatment that can be recommended. These sources are (*a*) cankers on the branches, (*b*) mummified fruits remaining on the trees and lying on the surface of the ground, and probably (*c*) infected leaves which have escaped desiccation during the winter months. The following treatment is therefore suggested :—

(1.) Cut out cankered branches, cutting some 3 in. below the visible point of infection.

(2.) Remove and destroy any black-rot mummies lying on the ground or hanging on the trees.

(3.) Plough in late autumn, after the leaves have fallen, and with a spade turn under portions beneath trees which have been left untouched by the plough.

The writer does not suggest that any treatment of cankers be practised, for at best this is difficult and involves a great amount of work; furthermore, as the hyphæ of the fungus spread in the sap-wood some distance beyond the visible point of infection, control at best would be uncertain. As many wounds are caused by branches rubbing together, trees should be pruned in such a manner as to prevent this. Finally, all wounded surfaces should, as soon as made, be coated with coal-tar.

SUMMARY.

(1.) Black-rot forms cankers on the branches, spots on the leaves, and causes rotting of fruits.

(2.) In New Zealand it is confined to the apple, pear, and quince, but in North America has been recorded on numerous other hosts.

(3.) On branches and fruits it behaves as a wound parasite, as it is apparently able to infect these only through some abrasion in the bark or epidermis; on leaves it behaves as a true parasite, infecting them directly through the epidermis.

(4.) Black-rot is caused by the fungus *Physalospora Cydoniae* Arnaud.

(5.) It overwinters by means of resting mycelium in cankers and mummified fruits, and probably in fallen leaves.

(6.) Remedial treatment consists in the removal of the sources of infection.

(7.) In New Zealand its economic importance is comparatively slight, but in certain States in North America it ranks second in importance only to black-spot as a disease of the apple.

LITERATURE CONSULTED.

ARNAUD, G. (1912): Notes Phytopathologiques. *Ann. L'école. Nat. Agr. Montpellier*, vol. 12, p. 9.

BROOKS, C., and DE MERITT, MISS M. (1912): Apple Leaf-spot. *Phytopathology*, vol. 2, p. 181.

HESLER, L. R. (1913): *Physalospora Cydoniae. Ibid.*, vol. 3, p. 290.

LEWIS, C. E. (1912): Inoculation Experiments with Fungi associated with Apple Leaf-spot and Canker. *Ibid.*, vol. 2, p. 49.

SCOTT, W. M., and RORER, J. B. (1908): Apple Leaf-spot caused by *Sphaeropsis malorum*. *U.S. Dept. Agr. Bull. 121*, p. 47.

SHEAR, C. L. (1910): Life-history of *Melanops Quercuum* (Schw.) Rehm. forma *Vitis* Sacc. *Science*, *n.s.*, vol. 31, p. 748. (1914): Life-history of *Sphaeropsis malorum* Berk. *Phytopathology*, vol. 4, p. 48.

MARKETING DANISH BUTTER IN BRITAIN.

IN reply to a question in the House, the Minister of Agriculture made the following brief statement regarding the marketing of Danish butter in Britain, with special reference to the Copenhagen quotation: "There are about fourteen hundred dairy factories in operation in Denmark. A few of these sell their produce weekly to firms in Great Britain. Another part is bought from the dairies by Danish exporting firms—often to standing orders week after week—mostly f.o.b. Danish ports. What butter remains unordered is generally consigned to wholesale houses in Great Britain to be sold for a commission. Other dairies have formed 'Butter Export Societies,' and these trade in just the same way as the private exporters. A number of these societies have formed an association for the purpose of securing the best possible prices, and also to improve the quality, and generally to further the interests of the societies. The fixing of weekly prices is carried out by the Copenhagen Butter Quotation Committee. This committee meets each Thursday. The basis of its deliberation is formed by reports from the various butter-markets, and very largely by the number or sizes of the orders received from customers at these markets. If the demand is above the average the quotation is increased; if less orders have come in, it is lowered. The quotation is an attempt to give, weekly, expression to the average price or value of Danish butter in the British markets. An error made one week is made good the next. If, for instance, the price be fixed too high, orders fall off, and the quotation is lowered next week, or *vice versa*."

BREEDING OF FARM ANIMALS.

THE LAWS OF HEREDITY.

Paper read by Mr. W. D. HUNT, Wellington, to the New Zealand Board of Agriculture.

I SHOULD like to state at the outset that I think it can be taken as an established fact that the first necessity in stock-breeding is ability to select the best animals; that knowledge of the laws of heredity is no use without this ability; that a breeder will never get anywhere either in breeding purebred stock or crossbred stock unless he has the ability to select good animals; that the person who wishes to succeed as a breeder of any class of animals must first learn how to select, and when he has learnt this, then—but not till then—will he be ready to make use of the knowledge of the laws of heredity.

I would like also to state before I go further that one of the first things a man must do if he wishes to succeed as a stock-breeder is to consider his country—what is the class of animal best suited to his country. The breed of stock must be selected that will suit the country they have to occupy. A breeder may be an excellent judge of his breed, and know the last word on the laws of heredity, but he will never get far if his stock does not suit his country. No breeder can succeed with his country working against him.

Another necessity, if a breeder is to be successful, is proper feeding. I do not mean overfeeding, but feeding that will give the stock a chance of full normal growth and development. Particularly is this necessary when the stock are young. An animal underfed when young may, if well fed afterwards, develop to normal size. Its growth, in fact, has been arrested for a time, and has afterwards moved on again until normal size has been reached. The period of starving, however, leaves its mark on constitution, and constitution is the most important attribute of all in stud stock.

The natural laws that govern heredity are not yet fully known; the study is as yet in its infancy. It is only about 168 years since Bakewell first started his work, and while he and other master breeders discovered the methods that were necessary to get the results they achieved, it is really only during quite recent years that we are beginning to learn some of the reasons why the methods adopted give the results obtained. In this connection it is found that the broad principles that govern inheritance are much the same in the vegetable world as in the animal world. Inquiry into the laws governing the inheritance of animals can be much helped by studying inheritance in plants. Experiments can be made with much larger numbers and in such shorter time with plants than is possible with animals, and definite results with plants are thus obtained much more quickly.

The work of the really successful breeders, both past and present, has been based upon the principle that "Like begets like, with a continual tendency to variation." In the working-out of the principle

it was found that while the offspring might come like the parents, it might also come like grandparents or more remote ancestors. This made it important that all the ancestors should be as nearly as possible alike in type, and all to be of the type that the breeder is aiming to get. This brought out the importance of purity of blood. All the ancestors must not only be of pure breed, but of similar strain and type. A crossbred may be as fine an animal as a purebred, but it was found it would not breed true. The same applies to the crossing of different strains within the same breed where the strains differ from each other in type.

While the first part of the principle "Like begets like" enabled breeders to fix their type, it was the second part of the principle, "with a continued tendency to variation," that enabled breeders to improve their stock. In nature no two things come alike. Every animal has individuality. Every animal is different from every other animal. There is perpetual variation. These variations are carried on to the next generation and lead to further variation. In nature the law of the survival of the fittest eliminates variations towards inferiority and perpetuates variations towards superiority. It is thus that the present animal and vegetable worlds have been established. The stud breeder temporarily suspends the law of the survival of the fittest and puts his own selection in its place. His job is to perpetuate all variations towards superiority, and cull out all variations towards inferiority. It is his success or otherwise in doing this that fixes his place as a breeder.

I said a breeder temporarily suspends the law of the survival of the fittest and puts his own selection in its place. Nature has for the time being merely transferred her law of the survival of the fittest from the breeder's stock to the breeder himself. If he selects his variations well he gets a market for his stock and he goes on breeding. If he selects unsuccessfully he loses his market and is forced out of the breeding business. Fortunately, nature's law always operates in the end. The stud breeder can only permanently take a hand if he is an improver. If he fails to improve he is forced out of the business.

I have tried to show the importance of pedigree, and at the same time the fallacy of thinking of pedigree only without seeing that the right animal is with it. Variations towards inferiority will perpetuate and intensify themselves just as surely—in fact, probably more surely—than variations towards superiority.

The Merino sheep which has been developed to its present state of perfection in a comparatively short time by the breeders of Australia and Tasmania is an example of what can be done by the skilful use of nature's variations. The Merino is grown almost entirely for wool, and the desire was to produce a sheep that would grow the greatest amount of the best quality of wool. The following is a note of results obtained by the noted Tasmanian breeder James Gibson, of Belle Vue Estate. These results were obtained entirely from Belle Vue blood; no outside blood was introduced.

In 1868 he bred the ram Sir Thomas, who was the most noted Merino of his time. He was sold when six years old for 680 guineas, which was the highest price up to that time ever paid for a Merino ram. The heaviest fleece Sir Thomas ever cut for twelve months'

growth was 12 lb. In 1872 Sir Thomas sired Sir Thomas 2nd, who cut 14 lb. of wool, an increase of 2 lb. on his sire. As an indication of the value put on Sir Thomas 2nd, he was sold when six years old for 604 guineas. In 1878 Sir Thomas 2nd got Golden Tom, who cut a fleece of 17 lb. He was sold when four years old for 500 guineas. In 1880 Golden Tom got Treasurer, who cut 18 lb. wool, and was sold in 1883 for 300 guineas. Treasurer got Golden Horn, who cut 20 lb. wool, and Golden Horn got Golden Horn 2nd, who cut 26 lb. In 1890 Golden Horn 2nd sired President, one of the most famous Merino rams ever known in Australia. He cut only 23 lb. wool, but he had with it a quality and evenness which, together with his general symmetry and bearing, made his name a household word all over Australia. He was sold in 1896, when six years old, for 1,600 guineas, the highest price paid up to that time for a Merino ram. In 1895 President got President 2nd, who cut 27 lb. wool. In 1898 President 2nd sired President 3rd, who cut 30 lb. wool. In 1900 President 3rd sired Patron, who cut $36\frac{3}{4}$ lb. wool. Patron was sold in 1907, when seven years old, for 1,000 guineas.

Thus in a little over thirty years, by selecting those variations in the direction of increased weight of wool, the weight was increased from 12 lb. to $36\frac{3}{4}$ lb., and this was done entirely within the flock without bringing in any outside blood.

THE MENDELIAN LAW AND SOME EXAMPLES.

The discoveries of Mendel have opened up a new field of thought and experiment in breeding, and explain the reasons for many results. These discoveries were first published in 1865, but their importance was not realized at the time, and it was not until the beginning of the present century that they became generally known even to scientists. As time passes, it is becoming more and more evident that the Mendel laws of heredity are very far-reaching, and it is worth considering them closely in connection with any breeding plans. Most people connect Mendel's results merely with the crossing of long and dwarf peas; but this was only one of his experiments. He found the same results were obtained with round and wrinkled pea-seeds, with yellow and green seeds, with brown and white seeds, with inflated and constricted pods, with green and yellow pods, and with axial and terminal position of flowers. In all these experiments the first-named quality was found to be dominant and the second recessive.

I will give an example of the working of the Mendel law in the breeding of live-stock. It is well known that red calves sometimes appear in pure herds of Aberdeen Angus cattle, and that red-and-white calves appear in pure Friesian herds of black-and-white cattle. Black and red are Mendelian characters. Black is dominant, and red recessive. A purebred black animal produces germ-cells which contain what is known as the factor for black. A purebred red animal produces germ-cells containing the factor for red. The birth of a new animal arises from the union of two germ-cells. If at some period in the history of the herd a pure-black animal is mated with a pure-red the result will be a union of black and red germ-cells. In the resulting egg which is to give rise to the new animal the black factor is dominant to or conceals the red, which is recessive; the calf, although black in appearance,

will contain the red factor in 50 per cent. of its germ-cells and the black factor in the remaining 50 per cent. For example, cross a black animal with a red and we get this result :—

	Black Animal.	Red Animal.
Germ-cells	Black	Red.

The result of this cross is a black animal, because black is dominant to red; but half the germ-cells of the progeny are red. Cross two animals bred this way and we get the following results :—

	Bull.	Cow.
50 per cent. germ-cells..	Black	Black.
50 per cent. germ-cells..	Red	Red.

The progeny may be the result of the meeting of a black germ from the bull with a black germ from the cow, and the result will be a pure-black carrying only the factor for black in its germ-cells. The progeny may be the result of a black germ from the bull meeting with a red germ from the cow, and the progeny, while black in colour, will have the factor for red in half its germ-cells. A similar result will come from the meeting of a red germ from the bull with a black germ from the cow. A fourth alternative is the meeting of a red germ from the bull with a red germ from the cow; the progeny will then not only be red in colour, but all its germ-cells will carry the factor for red, and it will breed true as a pure-red. One-fourth of the calves from this cross are therefore pure-blacks, one-half are blacks carrying the factor for red in half their germ-cells and the factor for black in the other half, and one-fourth are pure-reds. To illustrate the result :—

	Offspring.			
	No. 1.	No. 2.	No. 3.	No. 4.
50 per cent. germ-cells ..	Black	Black	Black	Red.
50 per cent. germ-cells ..	Black	Red	Red	Red.

No. 1 bred with another pure-black will breed true blacks. No. 2 and No. 3 bred together will give the same results over again as those first explained; and No. 4 is a pure-red, and if bred with other pure-reds will breed true.

Now let us examine the result of crossing offspring Nos. 1 and 2. We get the following :—

	No. 1.	No. 2.
50 per cent. germ-cells	Black	Black.
50 per cent. germ-cells	Black	Red.

If either of the black germs from No. 1 unite with the black germ in No. 2 we get pure-blacks, but if either of the black germs in No. 1 unite with the red germ in No. 2 we get a black animal carrying the factor for red in half its germ-cells. Out of every four calves from this cross we get :—

	No. 1.	No. 2.	No. 3.	No. 4.
50 per cent. germ-cells ..	Black	Black	Black	Black.
50 per cent. germ-cells ..	Black	Black	Red	Red.

If we now cross No. 1 and No. 2 we get pure-blacks, but if we cross No. 2 and No. 3 we get the results again just explained. If we cross Nos. 3 and 4, as already explained, we get one pure-black to two blacks carrying the factor for red in half their germ-cells, and one, the fourth, will be a pure-red.

From the foregoing it will be seen (*a*) that before a red calf can appear in a black herd both sire and dam must both carry the factor

for red; (*b*) that if one animal were introduced into a herd which, although itself black, carried the factor for red, it would be possible in time by selection for red to convert the whole herd into a red one.

The only way to make sure of keeping red out of a black herd is as follows: (*a*.) Before introducing a new bull into a herd try it out with some red or red-and-white cows. If it is a pure-black all the calves will come black. If it carries the factor for red about half the calves will come red. (*b*.) Watch the results obtained from bulls bred in the herd when used in crossbred herds. If any calves come red it is an indication that the bull carries the red factor. He must have got this either from his sire or dam. If the sire has been proved pure he must have inherited the red factor from the dam, and the dam should therefore be eliminated from the herd. (*c*.) If a red calf is born in a pure-black herd the sire and dam must both carry the red factor, and both should be eliminated from the herd.

I have dealt with the red and black factors in cattle at some length merely to give a practical illustration. This example will, I think, show the manner in which all Mendelian inheritance works. The same rules apply to other qualities or factors.

Pollies and horns in cattle are Mendelian factors, the polly quality being dominant and the horn quality recessive. The white face of the Hereford is a dominant factor also. An interesting cross in cattle is a pure Polled Angus with a pure Hereford. We have one parent with a black body and one with a red. Black is dominant, so the progeny will have a black body but carry the red factor in half its germ-cells. Polled quality of the Angus will dominate the horn quality of the Hereford, and the progeny will be polled but will carry the factor for horns in half its germ-cells. The white face of the Hereford will dominate the black face of the Angus, and the progeny will have a white face but will carry the factor for black in half its germ-cells. We can predict therefore with certainty that this cross, if the parents are pure, will produce animals with black bodies, white faces, and polled heads, but carrying in half their germ-cells the inheritance of a red body, in half the inheritance for horns, and in half the inheritance for black faces. These factors will, however, be mixed through each other, and the breeding together of these black-polled Herefords will produce most uneven results.

The foregoing deals with qualities that do not mix in the immediate offspring: the one quality dominates the other. A mixture of black and red cattle does not result in a composite colour: the first cross are all black, and the breeding of the progeny together produces either black or red. Mendel's crossing of long and dwarf peas did not produce any of intermediate length: the first crossing produced progeny all long, and these produced both long and short. There are other qualities, however, that do mix in the progeny, such as we see in the various kinds of crossbred animals that provide the great bulk of the farm-stock of this or any other country. Recent inquiries point in the direction of Mendelian rules governing this class of inheritance also when the crossbred animals are bred together.

An experiment was made of crossing a Gold-pencilled Hamburgh cock and a Silver Sebright bantam hen. These two differ greatly in size. The Hamburgh is, roughly, twice as heavy as the Silver Sebright.

The first-cross birds were of intermediate size — in fact, they showed the blended inheritance most breeders would expect. When, however, a further generation of over two hundred birds was raised from these crossbreds it was found that this consisted of all sorts of size, ranging from birds smaller than the Sebright to birds larger than the Hamburgh. Moreover, it was found that the small birds bred true to size at once, and there is evidence that strains of intermediate and of large size could also be established without difficulty.

BREEDING TRUE.

The last paragraph raises important questions to the stud breeder. It goes to show that although in the crossing of animals we often get progeny which to all outward appearance are of blended inheritance, this blended inheritance does not apply to the egg or germ-cells. The germ-cells in these crossbred animals contain a mixture of unit characters derived from their ancestry, but these unit characters are not blended—each is pure in itself. In breeding these crossbred animals together there can be no fixed type in the progeny, as it is just a matter of chance which unit characters come together to form the new animal. I think this explains the reason why stockmen who breed crossbreds find from experience that to get good results they must use a pure sire. The prepotency of a good purebred sire dominates the mixed inheritance of a crossbred dam, and at the same time the progeny gets the advantage of the increased vitality and vigour that seems to come from an outcross.

If we get the results stated in the last paragraph when different breeds are crossed, shall we not also get something of a similar nature, although less in degree, when different strains or types within the same breed are crossed? If this is true, then stud breeders must always bear this in mind when mating their animals. The object of stud breeding is not only to breed animals as near perfection as possible, but also to produce animals that will, when mated with similar animals, produce animals of similar type and quality; in other words, they must breed true. If the breeder produces fine animals, but they do not breed true, then he is a failure. Now, every stud breeder will have some ideal in his mind to aim at, and he will be constantly trying to bring his flock or his herd, or a large proportion of it, nearer his ideal. In doing this he can proceed in two ways: he can use sires of type and ancestry as near to his ideal as he can get them, or he can select sires specially with a view to correcting some weakness in his own animals — that is, if he thinks his own animals have gone to an extreme in one direction he can try and correct this by using sires that go to an extreme in the opposite direction.

Now, it seems to me that the first method is right and the second method wrong. The second method might get quicker results as far as the outward appearance of the animals is concerned, but it will not produce animals that will breed true. Let us take an example. Suppose a stud-sheep breeder thinks that his flock, or a portion of it, has become too coarse in the wool, and he wants to get it finer. Suppose he thinks he will attain his ideal quickest by selecting a sire finer in the wool than his ideal, but just so much finer that a blended inheritance will produce the wool he has in mind. Let us see the result.

The progeny may be just the sheep the breeder aimed at, but half their germ-cells will carry the fine-wool factor, and half will carry the coarse-wool factor; and when these are mated they will produce progeny one-fourth with fine wool which, if mated together, will breed true as a fine-woolled strain, one-fourth with coarse wool which mated together will breed true as coarse-woolled strain. The remaining half will be like their parents, having wool of the desired type, but which when bred together will not breed true, but will again break up into one-fourth fine, one-fourth coarse, and one-half correct wool but with mixed germ-cells.

Now, suppose that instead of selecting a fine-woolled sire with a view to bringing his wool to his ideal type a breeder selects a sire having wool of his ideal type and coming from stock that all had wool of this type. Call this ram "Perfection." The progeny will not in outward appearance be as near the breeder's ideal as the progeny from the fine-woolled ram; but let us think of the germ-cells. Each one of the progeny will have half its germ-cells carrying the factor of Perfection, and half carrying the factor for coarse wool. Breed the progeny together, and we have the following mating:—

		Ram.	Ewe.
50 per cent. germ-cells	..	Perfection	Perfection.
50 per cent. germ-cells	..	Coarse wool	Coarse wool.

The result of this cross will be that one-fourth of the progeny will have reached perfection and will breed true; one-half will be like their parents—that is, a cross between perfection and coarse wool; and the remaining one-fourth will have reverted to coarse wool, and if bred together will come true to this type.

If instead of breeding the progeny of Perfection and coarse wool together the ewes are bred to another Perfection ram, we have the following combination of germ-cells:—

		Ram.	Ewe.
50 per cent. germ-cells	..	Perfection	Perfection.
50 per cent. germ-cells	..	Perfection	Coarse wool.

The results of this cross will be that half the progeny will be Perfection and will breed true, the other half will be like the dams—that is, a cross between Perfection and coarse wool.

It seems to me, therefore, that the only way to produce a first-class flock or herd that will breed true is to continually use sires as near the ideal as possible, both in appearance and in ancestry; and that using sires of one extreme to correct dams of an opposite extreme will lead to disaster, although it may temporarily produce some good-looking stock. Further, if the good-looking stock bred this way are purchased by other stud breeders the results will disappoint the buyers.

SEX-LINKED INHERITANCE.

There is evidence to show that certain qualities of inheritance are sex-linked—that is, they are only inherited through the male or through the female. Experience goes to show that high fecundity or egg-laying power is linked up with the factor of maleness, so that the highest grade of laying-hen producing eggs, some of which will hatch into cockerels and others into pullets, transmits the high egg-laying capacity only to her sons and not to her daughters. The high-grade

layers must therefore get this factor from their fathers. This is why such high prices are paid for cockerels from hens with a high egg-record.

When a "silver" cock is mated to a "gold" hen these colours follow the regular Mendelian rules, silver being dominant. All the progeny are "silver," but carry the "gold" inheritance-factor in half their germ-cells. When, however, a "silver" hen is mated with a "gold" cock the progeny are "silver" cocks and "gold" hens. This shows still another peculiar difference in male and female inheritance.

Evidence, too, goes to show that milk and butterfat production in dairy cows is inherited more through the male than the female—that is, a high-producing cow transmits her producing-qualities more through her sons than through her daughters. It is becoming more and more recognized by dairymen that to improve their herds or maintain them at a high standard they must use bulls from high-producing dams.

INBREEDING, LINE-BREEDING, AND OUTCROSSING.

The questions of inbreeding, line-breeding, and outcrossing have probably been more discussed and written about than any other aspect in connection with the breeding of purebred stock. It seems to be generally agreed that close inbreeding (*a*) fixes type, (*b*) increases prepotency, (*c*) brings out and intensifies good qualities, (*d*) brings out and intensifies bad qualities, (*e*) if long continued, reduces vitality and size and weakens constitution. Outcrossing increases size, vitality, and constitution, but decreases prepotency, and tends to produce unevenness in type. There is always the risk, too, when bringing in an outcross, of introducing a bad quality or weakness that is very difficult to afterwards get rid of. The illustration given of results in crossing black and red cattle shows how difficult it is to get rid of a hidden red taint. The same principles apply to other qualities.

Line-breeding is the mating of animals not so closely related as the relationships that are looked upon as inbreeding. The principle involved is the same; the difference is one of degree. The idea behind line-breeding is to get the advantages of inbreeding, and at the same time to avoid its disadvantages, and also avoid the risks attached to the introduction of an outcross.

Experience and experiments go to show that the loss of vitality, size, and constitution that generally follows continued in-and-in breeding is quickly put right by the introduction of an outcross, and that no animals respond so quickly to the advantages of an outcross as animals that have for some time been closely inbred. The outcross seems in one generation to bring back the size, constitution, and vitality that was lost by continued inbreeding.

The aim of the stud breeder is to produce the most perfect animals possible, and at the same time animals that will breed true. To breed true the animals must have uniform germ-cells all carrying the same inheritance-factors. This uniformity of germ-cells is gained by close inbreeding. With an outcross there is always the danger of introducing germ-cells carrying the factor for some fault that it may prove afterwards very difficult to eliminate. The problem to be solved is to overcome the loss of size, vigour, and constitution brought about by continued inbreeding, and at the same time avoid or reduce to a

minimum the introduction through an outcross of germ-cells carrying faults.

The foregoing brings up the question of whether the best plan in a stud of considerable size is not to divide the stud into several families, and closely inbreed each within itself until weakness appears; then introduce a sire from one of the other inbred families, and continue the inbreeding again from his progeny until another outcross is required, when another inbred family can be drawn upon.

What I have said in the last paragraph, of course, only relates to the operations of a stud breeder who aspires to be a leader in his own particular breed, and who has reached a stage when he considers his stock at least equal to that of any other breeder. The vast majority of breeders are not in this position, and they cannot do better than each select a leading breeder whose stock conforms most closely to the ideal he is aiming at, and in whose breeding methods he has faith, and then go to this breeder whenever he is in need of an outside sire. The breeder who adopts this method will improve his stud much more rapidly and get a more even type than the breeder who goes all over the place for his sires.

The breeders of racehorses and dairy stock have the advantage of seeing the actual performances of the animals they produce. These performances are guide-posts indicating to them whether or not they are keeping on the right lines. Breeders of other classes of stock are more liable to the influences of fads and fancies that often prove to have no sound foundation, and are therefore only of a passing nature. The real breeder with a mind of his own must resist these passing fancies, and must hold closely to the ideal he has in his mind. This ideal must be of a practical nature. The ideal should be to produce the class of animals that will give the greatest return to their users on the class of country and the class of feed they will have to make use of. Like the racehorse and the dairy cow, the test of the quality of all classes of farm-stock must in the last analysis be performance or production.

THE QUESTION OF LOCATION.

In establishing a stud the question of location is most important. Animals can be changed in a few generations by environment. They quickly adapt themselves to new conditions. It is important that any changes in the stock caused by their location should be in the direction of strengthening and not weakening the suitability of the sires bred in the stud for the class of country and the conditions generally that they will have to adapt themselves to when sold. This is one of the reasons why sires bred in colder climates, as a rule, do well. An example of this is the important position that Scotland has now attained in the production of the highest class of stud stock. Another example is the Friesian breed of cattle, now the world's leading dairy breed; it was produced and developed in the cold and bleak plains of north Holland. In the United States, where this breed of cattle has been so successfully transplanted, the leading studs are in the northern States. To put the matter shortly, the location chosen for the stud should be one where the conditions are such that natural selection will eliminate any individual unable to thrive under the conditions the sires bred in the stud are likely to be placed in when sold.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

NOTES ON THE TARANAKI AND WANGANUI EDUCATION DISTRICTS COMPETITIONS: SEASON 1922–23.

J. W. DEEM, Fields Instructor, Department of Agriculture.

THE work of the agricultural clubs in the Taranaki and Wanganui districts in the 1922–23 season was carried out on the same general lines as in the preceding year. In the root-growing competitions, however, the conditions were slightly altered by raising the points allowed for cultivation from 20 to 40, and reducing the points allowed for weight from 2 points per ton to 1 point per ton. By this means it was felt that more encouragement would be given to cultivation, and that competitors with poorer land would be put on a more equal footing with one on an exceptionally rich area, it being possible under the new method for a crop much inferior in weight to beat the heavier one, provided more attention had been given to cultivation and records, which are considered the two most important points.

The central division in Taranaki was cut out and the area divided between north and south Taranaki. Swedes were also eliminated, and the root competitions confined to mangolds and carrots. The mangolds grown were Prizewinner Yellow Globe, and the carrots Matchless White.

In addition to the root-growing and calf-feeding competitions a poultry club was started at New Plymouth. There were not a great many competitors—twenty entering and seventeen carrying on—but it is hoped that this class of competition will extend. The procuring of broody hens at the right time seems to be one of the greatest difficulties.

ROOT-GROWING COMPETITIONS.

The season generally was excessively wet and not conducive to the best results from field operations, especially where young people were concerned. While there were many failures from this cause, the percentages of competitors who carried their plots right through to the judging-day are very gratifying. In the Taranaki district fifty-four schools made 491 entries, of which number 335, or 68·2 per cent., had their plots judged. In the Wanganui district sixteen schools made 138 entries, of which 70, or 50·7 per cent., were judged. As in previous years, the judges reported a considerable number of failures owing to stock gaining access to the plots. It is regrettable that no improvement has been shown in this direction.

The Taranaki results show that the heaviest crops are not quite up to the best yields of the previous year. This is fairly general in all classes of crops, no doubt due to the excessively wet autumn. On the other hand, the average yields for each school are more even than in previous years. Further, the judges found that cultivation had been better carried out. and that the average plot was much tidier than in previous years. This indicates a closer study of the instructions given from time to time, and a better knowledge on the part of the pupil,

no doubt gained from previous experience. In many instances these plots afforded a splendid object-lesson in cultivation. Frequently the competitor's plot was in splendid condition and gave a big yield, whereas the parent's crop in the same field was very light and badly weed-infested. Lessons of this nature must be advantageous all round.

The heaviest mangold crop was one of 132 tons 5 cwt. per acre, grown by Harry Betts, Okaiawa. Although considerably below last year's best crop of 152 tons, it is a very high yield, and reflects great credit on the grower. Last year's champion, Dorothy Ward, also belonged to Okaiawa. When it is mentioned that the five competitors at this school secured the fine average of 104 tons 5 cwt. per acre

THE TARANAKI CHAMPION MANGOLD CROP FOR 1922–23, AND THE GROWER, HARRY BETTS, OKAIAWA.

it will be realized that the Okaiawa competitors are keen mangold-growers. This is the first occasion since the competitions started that the championship has been won by a boy, the two previous winners being girls. The average mangold crop for the whole of the competitions was 48 tons 1 cwt. per acre.

In carrots the heaviest crop weighed 66 tons 12 cwt., against last year's best of 72 tons. The champion this year was Jane Keighly, of Matapu. The average carrot-yield per acre was 36 tons 8 cwt., against 35 tons 5 cwt. for the previous year.

The placings for the championships are as follows :—

South Taranaki.—Mangolds: Harry Betts, Okaiawa, first, 229 points (Taranaki champion); Erna Ward, Okaiawa, second, 220 points; Dorothy Ward, Okaiawa, third, 189 points.

Carrots: Jane Keighly, Matapu, first, 164½ points; Roy Green, Okaiawa, second, 157 points; Doreen Stanton, Rawhitiroa, third, 156 points.

North Taranaki.—Mangolds: Hazel Phillips, Mimi, first, 181½ points; Roy McKenzie, Tikorangi, second, 176 points; Elizabeth Free, Waiau, third, 167 points.

Carrots: Roy McKenzie, Tikorangi, first, 160 points; Bernard Brophy, Warea, second, 145½ points; Amy Phillips, Mimi, third, 135 points.

Wanganui-Feilding.—Mangolds: Elsie White, Glen Oroua, first, 170¾ points (divisional champion); Ivy McKay, Wangaehu, second, 163¼ points; Alison White, Glen Oroua, third, 160¼ points.

Following the practice of previous years, displays of roots were made at the New Plymouth, Hawera, and Palmerston North winter shows. At the two former the exhibition of roots was exceptionally good, the carrots being the finest I have ever seen staged, nearly every entry being worthy of a first prize in open competition. As in the past, these displays were a feature of the New Plymouth and Hawera shows; at Palmerston North the exhibit was rather poor.

CALF CLUBS.

These were confined to Taranaki. Altogether 259 calves were entered, of which 200, or 77·2 per cent., were brought forward to be judged. All the calves were graders, and represented the breeds as follows: Jersey, 161; Friesian, 25; Shorthorn, 12; Ayrshire, 2.

This year 100 points were allowed for cost of rearing, one point being deducted for every shilling of the cost of rearing. Thus, if the cost was £5, no points would be allowed; 100 points were allowed for condition, and 40 for record-charts. These points are not quite satisfactory, however, and may be altered for next year's competition. The average cost of food per calf in north Taranaki worked out at 17s. 7¾d., and in south Taranaki at 16s. 10d. The highest cost in the former division was £2 9s. 8d., and in the latter £2 2s. 6d.; the lowest costs were 3s. 6d. and 5s. 7½d. respectively.

GENERAL.

The general control of the clubs was on the same lines as previous years, the Farmers' Union, a number of individual farmers, and officers of the Education and Agriculture Departments co-operating. While it is generally admitted that these clubs serve a valuable purpose, the Farmers' Union is experiencing great difficulty in collecting sufficient funds to pay the prize-money. It would appear that unless the finances can be placed on a more satisfactory footing there is a danger of the movement falling through.

The Pukeokahu-Taoroa Rabbit District (Wellington) has been constituted for the purposes of Part III of the Rabbit Nuisance Act.

The West Coast Agricultural, Pastoral, and Industrial Association has been incorporated under the Agricultural and Pastoral Societies Act.

SEASONAL NOTES.

THE FARM.

SEPTEMBER is always a busy month in all classes of farming, and owing to the exceptionally wet, broken weather experienced during the past winter this year there will be an even greater rush of work than usual.

EARLY SPRING SOWINGS.

The sowing of cereal crops—wheat, oats, and barley—should be pushed along, except where the land is very wet. In such situations it is better to wait until it is reasonably dry before sowing, for where grain is sown on very wet land a great deal of it rots, and what does germinate makes poor growth.

For many districts Algerian oats give the best results, Gartons and similar varieties being very liable to rust. They should be sown at the rate of 3 bushels per acre, and on small areas where birds are likely to be troublesome it will pay to put in an extra half-bushel. Care should also be taken to see that the oats are well covered, in order to prevent birds getting them before they germinate; if the land has been firmed by rolling after sowing the birds will not pull out anything like so many seedlings after they come through the ground.

The Major variety of wheat is to be strongly recommended for the south Otago and Southland districts (as well as the North Island) on account of its early-maturing and quick-ripening characteristics. It yields well, and has proved a most suitable variety to grow.

Barley may be sown towards the end of September, or even in October, as it matures quicker than other cereals.

Grain crops sown at this time of the year will generally benefit from 1 cwt. to 2 cwt. of superphosphate per acre, according to the quality of the land. This fertilizer, besides bringing the crop away rapidly, stiffens the straw and helps the crop to ripen more evenly.

Many farmers will be sowing out grass-seed with the spring oats. This practice, although not of the best, has much to recommend it from an economy point of view, but the oat-sowing should be light, 1 bushel per acre being sufficient to give cover to the young grass. Heavy sowings of oats have a very depressing effect on pasture-establishment. The seeding with grass can often be delayed until the cereal is advanced well enough to stand harrowing.

A mixture of 20 lb. of Western Wolths rye-grass, 1 bushel of oats, and 4 lb. to 5 lb. of red clover per acre makes a good spring-sown hay crop, and may be put in early in September. Other special crops for hay or ensilage were dealt with last month.

FEEDING DOWN CEREAL CROPS.

The final feeding of autumn-sown crops should take place towards the end of September, the exception being rich areas where there is danger of the crop lodging. In such localities feeding may be continued into October. After the last feeding give the land a good harrowing with the tine harrows to open up the soil. If this harrowing leaves the land unduly rough, follow in a week with the roller. Owing to the subsoil being well soaked a very rapid growth can be expected in spring-sown cereals, and it may be necessary to feed off with sheep to prevent lodging and encourage tillering.

PREPARATIONS FOR LATER CROPS.

Lea land intended for late spring-sown forage crops should now be ploughed. It is most essential to allow plenty of time for the turf to rot before sowing the crop. Spring-sown forage crops require a large amount of water in the soil, and the only way to ensure an adequate supply of moisture is by means of early ploughing.

Land intended for rape, turnips, peas, potatoes, late sowings of vetches, and linseed should be cultivated as time permits. Owing to the delayed sowings of cereals there will be a tendency for late spring and summer crops to be neglected in this way. Land for mangolds and swedes should be deep-ploughed as soon as possible.

Old grassland intended for summer fallow should be cross-ploughed and thrown into rough lumps to allow the roots to be weathered and killed, especially if the land is infested with twitch of any description. The skimming should be deep enough to just get below the twitch and no more, probably 3 in. in old pasture.

IRRIGATION FARMING.

In Central Otago all irrigation ditches should by now be well cleaned and able to carry their full complement of water. Boxes must be repaired, and everything be in readiness for the irrigation season. Land intended for lucerne should be ploughed and kept cultivated to control fat-hen and sorrel prior to sowing in November. It is better to delay lucerne-sowing until November, thus allowing spring weeds to be overcome in the meantime.

LUCERNE.

Established stands of lucerne should be cut or quickly fed off about the end of September, and, if the land is dry, given a good cultivation. The object is to break the surface of the land which has become firm by too much grazing or constant rain, and allow the air to get in, also to shake up weeds and grass that have become established. If the field had a good autumn cultivation and was not heavily grazed during the winter the spring cultivation is simple, and can be done with a light cultivator or the tine harrows weighted with a few posts or a bag or two of soil. If, however, autumn cultivation was neglected, or the land has become badly infested with grass, the spring cultivation must be more drastic. In cases of this sort the best method is to give the paddock a good disking, in some cases several strokes being necessary. The disks should be run with as little set as possible, the object being to cut up the surface of land and grasses or weeds as small as possible. This having been accomplished, the loosened material can be shaken up by means of the cultivator or tine harrows. If the cultivator is used first in the spring on land badly infested with fog and similar grasses the ground is torn up in lumps, and subsequent working fails to properly break it up, with the result that it is almost impossible to get the mowing-machine over the paddock when cutting-time comes.

It should be remembered that spring cultivation is carried out more with the object of bringing about a rapid growth than destroying weeds, but if the cultivation is well done and carried out at the proper time—namely, when the weather conditions are suitable for the lucerne making rapid growth—the bulk of the weeds and grasses will be smothered. Lucerne should not be cultivated when the land is wet. If the stand cannot be worked reasonably dry it is better to leave it alone in the spring.

If the lucerne has not been doing very well and requires top-dressing this is the time for applying it, and provided the field has been liberally treated in the past with lime there is nothing better than superphosphate, which may be used at the rate of 2 cwt. or 3 cwt. per acre. Slower-acting phosphates like basic slag, Ephos, and Nauru rock are also useful, but they should be applied earlier in the season. Lucerne is expected to give heavy crops, and consequently must be well fertilized if the land is at all poor.

On old lucerne-fields that are becoming very thin the first cut of lucerne can be greatly improved by drilling 1½ bushels of oats in the ground after cultivation. The mixture of oats and lucerne is excellent for ensilage. Any weak patches in young lucerne-fields that were sown in the spring of last year can be greatly invigorated by top-dressing them with any well-rotted cowyard manure that is available. These weak patches usually show up along the "finishes" or on the hillsides, where the soil is thin, and quickly become a mass of weeds and grass if the lucerne is not helped along.

If green crops are being grown in preparation for lucerne they should be ploughed under during September. If this cannot be done it is better to feed them off and plough under the residue.

MISCELLANEOUS.

Ground in which it is intended to sow tares for seed should now be well prepared. In Marlborough this crop is best sown during September. The practice of sowing 2 bushels of tares with ½ bushel of oats, then feeding this off after it has made sufficient growth, has proved satisfactory. The tares smother the oats, and are easily harvested by use of the hay-rake. At the same time the oats during the growing-period serve the valuable purpose of keeping the tares more erect. September is also a good month in Marlborough for sowing peas for seed purposes.

Lucerne and cow-grass paddocks which are being set aside for seed-crop purposes should be thoroughly cultivated. If plants are too close together judicious grubbing-out will often be worth while—on smaller areas, at least. In order to yield good seed plants must have plenty of air and sunlight.

A peculiar position has arisen around Blenheim this year owing to the floods which took place in May. Until this month the ground has had little opportunity to dry. In many cases 6 in. or 8 in. of silt remains on the land. In the event of dry weather setting in this soil will cake, and working, if deferred too long, will become very difficult. A good plan is to run over the land with the cultivators to loosen and aerate the top soil, and follow by a surface-sowing of grass in the case of pasture. This has already been done on some of the flood areas. Similar advice may apply to some of the other localities which were flooded.

Fields that are intended for hay or ensilage should be shut up about the end of September. They should be thoroughly cleaned up and well harrowed to ensure a clean bottom for the mowing-machine. If not already top-dressed this may still be done, using superphosphate at the rate of 2 cwt. per acre, and where the land is light and poor 1 cwt. of blood-and-bone may be added.

—*Fields Division.*

CASTRATION AND DOCKING OF LAMBS.

One of the most important factors connected with these operations is to have the work carried out on clean ground, and under no consideration should the lambs be marked on the same ground two years in succession. The reason for this precaution is that the ground is soiled with blood, and consequently becomes a propagating-ground for bacteria, especially those which cause blood-poisoning or septicæmia. The organisms of tetanus, or lockjaw, must also be similarly guarded against.

The most suitable place is a clean grass-paddock, high-lying and well exposed to the sun. Low-lying and damp places should be avoided as far as possible. Bacteria must have moisture to keep them alive and multiplying, so that if the ground where the operation is carried out is wet or damp it may become a veritable incubator. On the other hand, ground in a high and dry position, well exposed to the sun, soon becomes clean, the sun's rays being the best disinfectant. On damp ground the moisture protects the disease organisms from the direct action of the sun.

Lambs should be castrated and docked when from three weeks to a month old. Marking lambs during the heat of the day or while heavy warm winds are blowing should be avoided as far as possible. The cool of the afternoon is the best time to carry out the work. For marking operations a few hurdles and coils of wire netting, together with a sufficient number of stakes, should be held in readiness. With these a pen and yard can be erected in a suitable part of the paddock where the ewes and lambs are to be folded.

The instruments required consist of two clean, sharp knives, together with a bucket of water to which has been added some disinfectant. The hands of the person operating should be well scrubbed in a solution of the disinfectant before commencing operations. The knife when not in use should be placed in the bucket containing the antiseptic solution.

The method of operating most often employed is as follows: The lamb is held by an assistant in such a position as to expose the pouch. The operator grasps the pouch at the tip and with one clean cut severs the end. The testicles are then pressed out and drawn. This is generally done with the teeth, but some operators prefer drawing the testicles with the fingers. If the cord should happen to be broken by rough handling before the testicle is properly drawn bleeding will be the result, and the blood collects in the pouch. This must be removed

and the pouch washed out with an antiseptic solution. The reason for this is that if a blood-clot collects in the pouch septicæmia supervenes, and death follows. The testicles and pouch-ends should be placed in a receptacle provided for this purpose. As soon as castration is completed the tail is grasped and severed with one clean cut. The cut is best made two or three joints from the stump; the joint can be felt by the finger and thumb. A weak disinfectant should be applied to the wounds before releasing the lamb.

The knife used for tailing should be a separate one from that used for opening the pouch. The knives and operator's hands should be dipped into the antiseptic after each operation. After the work is concluded the tails, testicles, and pouch-ends should be collected and destroyed by fire.

When marking is finished the ewes and lambs should be placed on good clean pasture with sufficient growth to keep the lambs' tails or pouch-ends from coming into contact with the soil. If these precautions are strictly observed any mortality from castration and docking should be reduced to a minimum.

—*F. Mackenzie, Live-stock Division.*

THE ORCHARD.

THE experience of the past season has proved conclusively that the Dominion markets are easily oversupplied with low-grade fruit; in fact, the demand for this grade at present is very limited, and fruitgrowing is not a profitable proposition unless the percentage of such fruit is kept down to 10 per cent. or thereabouts. Growers who have been unsuccessful in realizing this ideal should take courage from the fact that many are attaining it consistently year after year, and should again make an earnest effort. The reason for such success is not a secret, but merely lies in doing the right thing at the right time and doing it well.

SEASONAL SPRAYING.

Specially does the foregoing statement apply to orchard-spraying. Most of the pip-fruits are graded down for black-spot, and the stone-fruits for brown-rot, both diseases that can be controlled by proper spraying. Effective control requires the trees to be in good heart and the correct sprays to be applied at the right time. Again, the results of such a campaign largely depend on the initial effort. Black-spot and brown-rot fungi commence their new season's growth at the same time as the trees on which they live, and if they are allowed to establish themselves before preventive measures are taken the battle is lost, or, at best, the results will be unsatisfactory.

To prevent the loss of laterals, spurs, and fruit through brown-rot on apricot, peach, and stone-fruit trees generally, follow up the spray recommended last month with a further application of bordeaux, 8–6–40, as the blossoms commence to open—usually early in the month of September. Owing to the variable quality of quicklime it is always desirable to test bordeaux that is about to be applied to trees in growth; should there be any sign of acidity more milk of lime must be added until this is neutralized.

Towards the middle of this month pear and apple trees commence to resume their growth. Just before this takes place the first fungicide spray for the prevention of black-spot must be applied. In the districts and localities where this fungus gives comparatively little trouble, and probably powdery mildew and red mite are the worst offenders, the fungicide used may be lime-sulphur concentrate, 1 gallon to 10 gallons of water. In applying, close down the aperture of the spray-nozzle somewhat and give the job plenty of time, covering branches above and below. Where black-spot has been troublesome use bordeaux, 8–6–40, at the same period in place of the lime-sulphur, using the greatest care in mixing and applying. Should the trees also be affected with scale insects, aphides, or red or blister mites, follow this application almost immediately with red oil—1 gallon to 15 or 20 gallons of water—taking care that a good emulsion is obtained. These are the most important sprays of the year, and a clean crop cannot be harvested without them.

CULTIVATION AND PLANTING.

During the interval that follows these spraying operations the orchard should be ploughed and harrowed down, if this has not already been done. A special plough should be used for getting close in to the trees, thus avoiding the necessity of using the hand-grubber. Much damage is sometimes done at this season by ploughing too deep and cutting up the roots. Frequently it is done by ploughing the same way twice; if the ploughing was towards the line of trees last time, reverse it by ploughing away, and so leave the land level. Avoid working the land when it is wet. *Complete all new planting this month.*

GRAFTING.

Reworking trees by grafting may be carried out as soon as the trees commence to make new growth. Before cutting the trees down and preparing the stocks, carefully consider the best point for reworking, and retain the old forks if possible. Poorly cut scions of unripe wood, insufficiently tied and only partially waxed, are the commonest causes of failures. Scions must be held in firm contact with the stock for the whole length of the splice, and air excluded from the whole operation by a generous application of wax. Inspect them occasionally afterwards to see that the ties and wax remain in place and are effective.

—*W. C. Hyde, Orchard Instructor, Nelson.*

POULTRY-KEEPING.

EARLY HATCHING.

It should be unnecessary to reiterate that where winter eggs are the objective aimed at all chickens intended to be reared should be hatched out not later than September. Chickens hatched later than that make unsatisfactory stock, and the later the hatching the more disappointing are the results. Indeed, with the present cost of foodstuffs it is next to impossible for late-hatched birds to show even a fair profit over the cost of their keep. Not only do they lay only in the cheap-egg season, but they involve constant trouble with disease, and seldom or never make good breeding-stock, however good the strain.

Where possible, the aim of the poultry-keeper should be to secure all his chickens during two months — August and September — instead of extending hatching operations over a period of about five months, which is often the case. If the most money is to be made from the business it is not sufficient to have merely a small proportion of the pullets laying when eggs are worth most money; the great majority of the pullets must be in a productive condition if a payable winter-egg yield is to be secured. It should always be remembered that one egg in winter is usually worth more than two in summer, and it is the early hatched pullet that produces the dear egg. Thus on all plants an endeavour should be made to secure the required number of chicks at the earliest possible moment.

BROODING-POINTS.

Always at this season of the year I receive many complaints regarding mortality among young chickens that are being artificially reared. Usually my correspondents satisfy themselves that their loss is due to bad luck or to some mysterious epidemic form of disease over which they have no control. In most cases, however, there is nothing mysterious about it, the cause being mismanagement and nothing else. The man who is successful in rearing brooder chicks leaves nothing to chance. In the first place, he sees that his breeding-stock are in the best possible condition for the production of vigorous progeny. When the chicks are hatched out he keeps a close watch on them, and on the first sign of anything wrong he looks for the cause and removes it. He also takes climatic conditions into account, and sees that the right degree of heat is maintained both by day and night under the hover, as well as an ample supply of fresh air. This means long hours of work and giving the young birds almost constant attention.

In regard to success or otherwise in artificially rearing chicks, too many breeders fail to follow the set of instructions provided by the mother hen and

her brood. They attach the main importance to the food supplied. Good feeding is certainly an essential, but it is only one important link in the chain of management. For example, it is common to see chickens with the mother hen doing remarkably well on a class of food that would on its appearance alone be condemned for brooder chickens. The palpable lesson is that warmth—and this at a uniform temperature—is more essential than the providing of any special ration for the young birds. Herein is seen the prevailing weakness in artificial rearing. The chickens seldom enjoy that absolutely uniform degree of warmth and fresh air which they receive when being reared in a natural way. The hen studies weather conditions, and so must the poultry-keeper if he is to rear his chickens successfully.

The chief cause of brooder mortality lies in allowing the chickens to become chilled. Thousands of chickens die annually from no other cause. Chills are most commonly due to the temperature of the brooder not being maintained at a uniform degree, or to the chickens being allowed too much freedom for the first few days. Here the mother hen gives a striking lesson. For the first few days she keeps the chicks under her wings, where they are warm and comfortable, but at the same time are given an opportunity to breathe fresh air, that great essential for their welfare; during this period the time given them to feed and exercise is strictly limited. As they grow older, and providing the weather is favourable, the time given to exercise is extended by degrees, but on no account does she neglect to give them a warm-up when required.

The most pronounced sign that chickens have been chilled is the occurrence of bowel trouble, and once chicks become so affected there is practically no cure. Preventive measures at all times are really the only safeguards, and the chief of these is the maintenance of an even temperature and good ventilation in the brooder, together with strict attention to cleanliness.

There are also other details that must be observed if the young birds are to thrive and do well. For instance, the food supplied should contain all the elements necessary for healthy growth and development. Never feed inferior or musty grain because it is cheap. Do not on any account fail to provide an ample supply of succulent green material; chickens will never thrive in its absence. Keep always before the chickens a supply of fine grit, fine granulated charcoal, and clean water; dry wheat-bran should also be always within reach of the little ones. Another important matter is to see that the chicks get plenty of exercise, as they would in a state of nature. For this purpose the floor of the brooder-house should be littered with dry straw chaff (not oaten chaff) in which the dry broken grains should be scattered. To have to scratch for their food is instinctive to chickens, and if deprived of this exercise they will soon acquire such vices as toe and vent picking, &c., to say nothing of their ceasing to thrive.

FEEDING THE LAYING-BIRDS.

Now that the laying flock has settled down to heavy production the hens are apt to seriously decrease in weight, owing to the great demand on the bird's body-fat content for the formation of yolks, which largely consist of fat. Especially does this apply to pullets. Thus, if the birds are to be maintained in a healthy productive condition, sound and liberal feeding is imperative. If the birds are not well supplied with the elements necessary for the formation of eggs not only will the egg-yield decrease, but in addition the eggs that are laid will rapidly become smaller, while the yolks will not be of the desired rich colour.

The good layer is always a heavy feeder, and those who advocate keeping her on a scant ration have probably had little or no experience in profitable egg-production. The day has gone for saying that hens are too fat to lay. Where they become too fat it indicates that the food supplied is of the wrong kind, or that the birds are not concerned in heavy egg-production owing to their being of a poor laying-strain, or that they have passed their best period of production. An egg is one of the most concentrated and richest food products known. Obviously, a hen cannot be expected to lay day after day a 2 oz. product if kept in a state of semi-starvation.

There are no fixed rules that can be laid down as to the daily ration required by a laying flock. If the best results are to be obtained the poultry-keeper must have an observant eye, and must use his judgment by way of anticipating the birds' requirements.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

SPRING WORK.

FULL advantage should be taken of the mild spring days to overhaul the hives. When the temperature will allow, the work should go on steadily, and notes should be made after inspection of the condition of the colonies. Do not delay the spring examination until brood-rearing has commenced in earnest. By the time of the first inspection small patches of brood should be formed, and under favourable conditions the quantity will rapidly increase, depending largely, of course, upon the amount of stores in the hives and the quality of the queens.

The spring months are the most critical to the beekeeper, as the bees are taking a steady toll of the stores, and if care has not been taken in the autumn to see that each colony contained at least 35 lb. to 40 lb. of honey, cases of starvation may occur. The practice of placing colonies in winter quarters with a short food-supply is not to be commended, for it must ever be borne in mind that the foundation of the next season's crop depends largely, if not almost entirely, upon the condition of the hives when they are placed in winter quarters. Spring feeding is a temporary expedient to evade starvation, and should not be looked upon as part of the regular spring work.

Removing Supers.

Where it was found necessary to leave supers on the hives these may now be removed and the bees confined to the brood-chambers. What constitutes the brood-chamber depends on the beekeeper and his methods of working. Of late years the tendency has been towards increasing the size of the brood-chamber proper, and in place of the usual ten combs a brood-nest of eighteen to twenty frames is now generally accepted to make for large colonies in addition to providing room for expansion as brood-rearing proceeds. In cases where the bees have entered the supers and deserted the brood-combs, place the supers containing the bees on the bottom-board and remove the combs to the storehouse. See that the hives are made snug, and provide each with one or two spare mats to conserve the heat of the cluster.

Queen-right Colonies.

Normally, at this season brood-rearing will be in progress, and an inspection of the hives will determine as to whether or not the colonies are queen-right. The extent of the brood-rearing depends largely upon the weather prevailing, locality, and altitude, and these factors must be taken into consideration. If no eggs or brood be found it may be safe to assume that the colony is queenless, and such a colony must not be tolerated, as there is a danger of its being robbed of its stores by other colonies and an epidemic of robbing started in the apiary.

To unite a queenless colony to a queen-right hive proceed as follows: Prepare the queen-right hive during the day by removing the cover and mat and placing a sheet of newspaper over it. In the evening lift the queenless hive off the bottom-board and place it over the queen-right hive. In the course of a few days the bees in the weaker hive will eat their way through the paper and unite peaceably with the bees in the stronger one. If not required, the surplus combs containing honey may subsequently be removed and stored away for feeding. This method is simple, and rarely causes any fighting between the united colonies.

Overhauling the Hives.

Each hive should be thoroughly overhauled during the mild spring days. There is usually an accumulation of pollen, cappings, and dead bees on the bottom-boards, which matter, if left, becomes mouldy and objectionable, besides acting as a harbour for insects. The operation of clearing the bottom-boards can be facilitated by providing a spare one. Lift the hive on to the spare bottom-board, scrape the dirty one thoroughly, and then replace the hive. Where necessary, each hive should be given a coat of paint, while in damp situations, in order to preserve the life of the bottom-boards, a thin coat of tar applied to the under-surface will be effective. Clear all weeds and grass from the hives: they act as a harbour for insects and keep the bottom-boards damp.

REMOVAL OF BEES FROM BUILDINGS.

When bees take up a position in a building they in course of time become troublesome to their owners. In the busy season, when they are flying freely, they usually find access to other quarters, to the annoyance and general discomfort of everybody concerned; and, as the bees in most cases select a location behind the weatherboards or under the eaves of the house, they are hard to remove. Fumigation is not as a rule successful, as it is well-nigh impossible to get the poisonous gases confined to the quarters the bees are occupying.

The quickest plan to adopt is to strip the weatherboards or otherwise remove parts of the building so as to expose the combs. If the services of a beekeeper are not available bees can be successfully removed by proceeding as follows: In case the person is unused to handling bees, or is nervous, a veil should be worn. Take a bee-smoker and charge with dry sacking, so that when lighted the smoke can be forced in at the entrances which the bees are using. Usually a few puffs of dense smoke will drive the bees to the honey, and they can then be handled without much risk of the operator getting stung. The weatherboards or other material can then be removed, the bees brushed into a box, and the combs removed. After the operation is complete, block up all entrances so as to prevent further swarms from taking possession; and if provision is made for smearing the inside woodwork with carbolic acid or a pungent chemical this will act as a deterrent to bees again entering the building.

If the position the swarm has taken up in the building will permit of a hive being placed so that the crevice through which the bees have been passing adjoins the entrance to the hive, the bees may be removed by means of a bee-escape. This will obviate the handling necessary in the other method described. It is first necessary to stop up all the openings except one. Over this should be placed a Porter bee-escape, through which the bees can come out but cannot re-enter. In the hive place several combs, including one containing brood with adhering bees, care being taken to see that eggs and hatching-brood are both present. As the bees pass out of the building they will be unable to find their way back, and will enter the hive.

In a few days the field-bees will all have entered the hive, and in the course of time the emerging bees will shortly follow those outside, with the result that the entire colony, with the exception of a very few bees, will be in the hive. The bees in the hive, finding themselves without a queen, will raise one from the young larvæ in the comb provided. The nurse-bees will care for the brood in the old home, with the result that the colony will be transferred with little loss. In a few weeks' time, when the bees have settled down and the young queen has started to lay, the escape can be removed, and the bees allowed access to the honey in the old brood-nest. They will remove this and carry it into the hive. When the operation is complete the hive can be removed to a location in the garden, and the entrance to the building closed so as to prevent another swarm occupying the same position. When the hive is removed take the usual precautions to prevent the bees from returning to the old location.

—*E. A. Earp, Senior Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

EARLY crops of cabbages and cauliflowers will in forward districts now be well advanced in growth. If growth is not quite satisfactory apply nitrate of soda, ¾ oz. to 1 oz. per square yard, and repeat the dressing four or five weeks later. In later districts the surface soil should be loosened, where possible, after heavy rain. Nitrate of soda should not be applied till the normal frost period is past; after that it can be counted on to produce good results.

In some places cabbages and lettuces lose their bottom leaves, which turn yellow, and often show patches of grey mould. The grey mould is a fungus known as *Botrytis cinerea*, an early form of a damaging disease, *Sclerotinia fuekeliana.* The *Botrytis* form occurs only in wet conditions, and generally is the result of poorly drained soil or continued rainfall. If, however, it advances to the *Sclerotinia*

stage this will continue to advance regardless of weather, and in the end will destroy the plants, while the sclerotes falling to the ground will perpetuate the disease.

Affected leaves should be removed as soon as detected, and the stems of the plants dusted with air-slaked lime. The detached leaves should not be left on the ground; they may be composted with lime or buried very deeply in the soil. The disease, which is a very serious one, is far more prevalent than is supposed; it usually escapes notice until plants are killed. A good many plants are affected, including tomatoes and potatoes; but most frequently the first appearance is on lettuces and cabbages, because the way the bottom leaves rest on the soil creates conditions favourable to the disease.

Seeds to be sown at this period include peas, spinach, turnips, and turnip-rooted red beet, while broad beans may be sown if not already in. Celery for the main crop should be sown about the 15th September. Celiriac—known as turnip-rooted celery—is a valuable vegetable not so much grown as it should be; it is raised in the same way as celery. Tomatoes for late crops should be sown early in September. Plant potatoes, rhubarb, Jerusalem artichokes, cabbage, cauliflowers, lettuce, shallots, garlic, and various herbs—such as thyme, sage, mint, savoury, and marjoram—and sow or plant parsley.

Asparagus.

Asparagus-roots are active some time before the heads show through the ground, which in middle districts occurs early in September. The best time to plant is as soon as the roots are active, but if a head or two has broken it will do no harm. The activity of the roots prevents damaged roots dying back, and ensures a good start. If the plants have to be procured from a distance they must be packed in damp material. If raised on the place they should be placed between damp sacking and exposed as little as possible.

To plant, make a trench 6 in. deep with a shovel; then with a rake make a ridge in the centre of the trench by drawing up soil from each side of the floor of the trench. The plants should be placed on the top of the ridge with the roots spread on each slope, as on a saddle. The soil should then be returned, leaving the crowns from 2 in. to 3 in. below the surface. Modern practice is not to plant closely in beds, but at greater distances apart in lines on the flat. It would be better to plant one or two rows the whole length of a plot than a number of shorter rows side by side. In large plantations the rows should be from 30 in. to 36 in. apart, and the plants at least 15 in. apart, a greater distance being better. Two rows 18 in. apart, with the plants 18 in. asunder, is a good arrangement. This style of planting produces better heads than do crowded plants on the old-fashioned beds.

Established beds or plantations that have been previously covered with manure should now be put in order. In the case of beds, the soil previously taken off should now be returned to cover the manure. Where plants are in rows a light forking-over will be wanted. Where a good dressing of manure has been given, no fertilizer will be necessary except nitrate of soda, which should not be left out. Asparagus is benefited more by heavy manuring than is any other crop, except perhaps rhubarb. Nitrate of soda may be used with advantage in sufficient quantity to act as a weed-killer where necessary; it will also kill slugs. Amounts up to 6 oz. per square yard may be used.

SMALL-FRUITS.

Strawberries in most places are now coming into flower. If growth is not satisfactory a dressing of nitrate of soda should be given; 1 oz. per square yard, equal to 3 cwt. per acre, is sufficient. Nitrate of soda should not be applied till flowering begins, because if given earlier it is liable to cause luxuriant leaf-growth at the expense of the fruit. Weeds should be hoed out before the fertilizer is applied. Mulching-material should be prepared for application before the fruit-stalks extend too much. Materials suitable for the purpose include spent hops for small areas, or strawy stable manure, straw, rushes, pine-needles, and coarsely cut chaff. Where a good mulch can be afforded it serves to conserve moisture, as well as to keep the fruit clean.

Cape gooseberries may now be planted generally, and old plants cut down to the new shoots now appearing.

—*W. H. Taylor, Horticulturist.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

CHEESE-YIELD FROM FRIESIAN AND JERSEY MILK.

"ANONYMOUS," Hastings :—

Does the milk of a Friesian cow with a 3·6 butterfat test produce more or less cheese than that of a Jersey cow with a 5·0 test, the milk being in equal quantity ?

The Dairy Division :—

Under ordinary working-conditions there will be quite a variation in the yield of cheese from the two milks. The richer milk not only contains more fat, but also more casein. These are the two principal solids of milk which are found in cheese. The casein content varies in milks from different cows of the same breed, but if we assume that the Friesian milk contained 2·3 per cent. casein and the Jersey 3 per cent., the yield of cheese from 100 lb. of the Friesian milk would probably be about 9·6 lb., and from 100 lb. of the Jersey milk 13 lb.

ABORTION - CONTAMINATED PADDOCKS.

M. A. W., Tirau :—

I have been unfortunate in having some of my cows and heifers affected with abortion after carrying their calves about eight months. The animals have been confined to two small paddocks which are used as calf and bull paddocks during the early part of the milking season. Kindly inform me if any harm will result from the present use of the paddocks.

The Live-stock Division :—

It is not advisable to graze either bulls or calves on paddocks contaminated by the discharge from aborted cows. Such paddocks should be kept free of cattle for at least six months. Probably the best procedure would be either to graze sheep there or cultivate the paddocks.

HUBAM CLOVER.

"ONE IN DOUBT," Mangaohae :—

Will you kindly give any information you may have as to the usefulness of Hubam clover? Is it an annual or a perennial, and has it any advantages for particular purposes or positions, as compared with other clovers ?

The Fields Division :—

Sweet or Hubam clover (*Melilotus alba* var.) is a biennial, and should be sown in the spring at the rate of 10 lb. per acre on a well-consolidated seed-bed. Seed can be obtained from Messrs. Law - Somner Proprietary (Limited), Block Place and Swanson Street, Melbourne. Sweet clover, except in its young stages, is not relished by stock on account of its bitter taste. The stems become woody at flowering-time, and hence the crop is not very palatable either as hay or ensilage. It shows no advantage over our ordinary forage crops.

LUPINS FOR ORCHARD GREEN-MANURING.

R. S., Ripponvale :—

Would you kindly inform me the best kind of lupin to sow for green manure in an orchard ; also what quantity of seed and superphosphate to sow per acre, and where good reliable seed could be procured ?

The Horticulture Division :—

The blue lupin is recommended, being quicker in growth than the white variety. If sown in November the crop should be ready for turning under in May—a very good season, giving time for decay before the trees become active in spring. Sow 60 lb. of seed, in drills 12 in. to 15 in. apart, with 2 cwt. of superphosphate. If the seeds are broadcasted 80 lb. is required. Seeds should be procurable from any large seed firm.

DRYING-OFF OF COWS.

"RED CLOVER," Parkhill :—

How long do you consider a heifer should be milked before having her second calf ?

The Live-stock Division :—

It may be accepted as a common rule that a cow or heifer should be dried off at least two months before calving. This is necessary for the well-being of both cow and offspring. The fact of carrying a heifer on right up to the time of calving again will not improve her as a milker, and is detrimental to the calf she is carrying as well as to herself. About the end of the sixth and beginning of the seventh month of pregnancy the quantity of milk naturally diminishes, and the animal dries off of her own accord even although she is well fed and attended to. This, however, does not hold good in many of our highly developed deep-milking breeds, with which it is not unusual to have the milk-yield going on with no tendency to stop in the late months of pregnancy. In such cases it may be necessary to milk once a day or once in two days right up to calving, to avoid udder troubles. This is seldom followed by any harm to either cow or calf where the dam's tendency is to milk on, but to try to encourage the term of lactation beyond the seventh month of pregnancy, especially when the tendency of the animal is to dry off, is bad practice, and, as already stated, will not improve the cow as a milker.

HORSES AND WHEAT.

"SUBSCRIBER," Ashburton :—

Please advise treatment for horses that have had access to wheat by accident. I would like to be prepared.

The Live-stock Division :—

The treatment necessary depends largely on the amount of wheat consumed by the animal. If a horse is not engorged the first symptoms noticed are those of laminitis, or founder. If the amount consumed is large it causes dilation of the stomach. The main treatment in both cases is the evacuation of the stomach-contents by the aid of purgatives. For this purpose an aloetic ball containing from 5 to 7 drams may be given. For heavy draught horses 7 drams is sufficient. All dry or solid feed should be kept from the horse, but the animal should be given an ample supply of drinking-water. Luke-warm-water enemas should be given every three hours until the bowels respond and the contents of the stomach and bowels are evacuated. The horse should be starved for forty-eight hours, and only easily digestible food, such as bran or linseed mashes, should be given for a few days.

CONTROL OF SLUGS AND SNAILS.

H. S. STRATFORD, Crail Bay, Pelorus Sound :—

We are very much troubled with slugs in our locality. Many people from outside districts have recommended hedgehogs to combat the pest, and I would like to have your opinion regarding their use. There are no frogs in our locality. Do you think that if we brought them here it would be a step in the right direction ?

The Horticulture Division :—

Hedgehogs are now becoming fairly plentiful in a number of places in New Zealand, but are, of course, not often seen, as they lie hidden during the day. They certainly do devour slugs, snails, worms, and large insects, and naturalists regard them as friends to gardeners. Gardeners, however, usually regard them as friends only when they are outside the garden, for they also eat young plants and roots—not to mention milk, meat, hen's eggs, and young chicks. English horticultural journals frequently contain matter regarding slugs and snails, but they never advise the use of the hedgehog, which is a native of England. Frogs are useful for the control of woodlice, but so far as we are aware they do not eat slugs and snails. Readily effective means for the control of these pests are clean cultivation and the free use of air-slaked quicklime after dark.

Grading of Butter and Cheese for Export.—During the twelve months from August, 1922, to July, 1923, the following quantities were graded by the Dairy Division at the various ports, amounts for the corresponding previous yearly period being given in parentheses: Butter, 67,850 tons (50,548); cheese, 61,220 tons (63,790). These figures represent a net increase of 20·1 per cent. in butterfat production for butter- and cheese-making in the 1922–23 period.

Fees for Grading of Dairy-produce.—Amending regulations under the Dairy Industry Act fix the fee for butter at 1·05d. per box and for cheese at 1·40d. per crate. In the case of butter or cheese forwarded for export from a registered factory, creamery, or private dairy, the fee is payable by the manufacturer on demand; otherwise it is payable by the owner of the produce. Where it is found that the total amount paid in respect of grading-fees in any year ending the 31st March exceeds the cost, as determined by the Minister of Agriculture, of the dairy-grading service, including the salary and expenses of the Government Dairy-produce Officer in London, the Minister may credit to the payers of fees, towards the fees payable by them during the next succeeding year, the amount paid or payable in excess of such cost, in the proportion in which each payer contributed during the period in question.

Grading of New Zealand Hemp.—Amending regulations dealing with the grading and export of stripper-tow (carded stripper-slips) were published in the *Gazette* of 12th July. Three grades are established for this by-product, together with prescriptions for size of bales, tagging, &c.

Local Wool-sales.—During the season 1st July, 1922, to 30th June, 1923, there was offered at the wool-sales in New Zealand a total of 509,880 bales of wool, of which 457,547 bales were sold, the average price per pound being 10·40d. In the 1921–22 season 440,014 bales were offered locally and 405,125 sold, at an average of 6·06d. per pound.

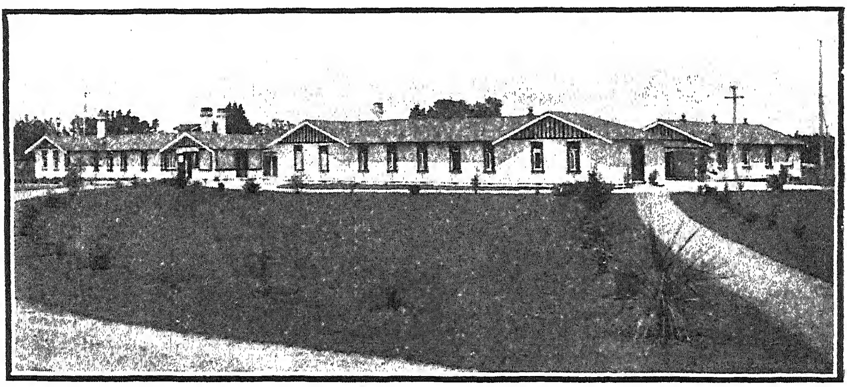
British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 4th August: *Peas*—New Zealand Maple have arrived freely; stocks on hand and awaiting discharge at docks are more than sufficient for present requirements. July shipments sold for 80s. per quarter; September-October shipments, 82s. 6d.; very little forward business. Tasmanian are scarce; July-August shipments sold at 92s. Small sales of blue reported; New Zealand 90s. ex store, and 82s. 6d. asked for parcels to arrive. Japanese cheap; new crop hand-picked marrow-fats, delivery to be in two equal lots in November and December, quoted at £22 10s. per ton. *Beans*—Sale slow. English winter making 8s. 10d. to 9s. 6d. per cwt., according to quality; Pigeon, 12s. to 18s. per cwt. Chinese horse, August-October shipments, quoted at 10s. 3d. per cwt.

RUAKURA FARM SCHOOL FOR YOUTHS.

THE new permanent farm training-school for youths at the Ruakura Farm of Instruction, Hamilton, was opened on 15th August with some twenty students as a commencement.

The school is designed to provide a course of agricultural training for lads of not less than sixteen years of age and of reasonable educational attainments. The period of training will occupy two full years, divided into four terms of twenty-three weeks each, with vacation periods of three weeks between each term.

Approximately one half of each term is to be devoted to the actual carrying-out by the student himself, under direction, of all classes of farm-work incidental to the management of a farm where cropping, grazing, milk-production, meat-production, and stock-breeding are carried out. The other half of each term is to be devoted to direct instruction covering the main features of agricultural knowledge necessary to equip the student to become a successful farmer. The objective of the course is to turn out young men well versed in practical farming and live-stock management, with at the same time a good grounding in the sciences essential in the planning and management of the modern farm.



RESIDENTIAL QUARTERS, CLASS-ROOMS, ETC., OF THE RUAKURA FARM SCHOOL FOR YOUTHS.

[*Photo by I. Hopkins.*

In the course the principles of scientific agriculture will be given special prominence, but more from the viewpoint of the requirement of the farmer than that of the agricultural teacher or research worker. Qualified agricultural teachers will direct and superintend this side, which includes agriculture, agricultural botany and zoology, agricultural chemistry, farm veterinary science, farm mathematics and mechanics, mechanical drawing, and farm book-keeping. It is intended that the work in these subjects shall closely follow that laid down in the syllabus of the New Zealand University, but, with the exception of agriculture, be somewhat more elementary in character.

A further twenty lads will be taken at the school in February next, the plan being to maintain a total strength of between forty and fifty. The residential quarters, class-rooms, &c., occupy the buildings previously erected and used for the training of returned soldiers. A fee of £36 per annum is charged to students as a contribution towards the cost of board and maintenance.

WEATHER RECORDS: JULY, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

JULY is, meteorologically speaking, the midwinter month of the Southern Hemisphere, and in New Zealand has been associated with some heavy falls of snow and hard frosts, especially in the South Island. A westerly depression between the 1st and 6th of the month accounted for the widest and heaviest falls of snow, which came down low in the South. Very cold and frosty conditions followed, and one observer states that "at this time the ground was for days as hard as iron, and the sun had no more effect on the frost than the moon." From the 16th to the 23rd the weather generally was dull, misty, and wet. Several ex-tropical disturbances passed in the North in this period. A remarkably heavy rainfall was experienced in Poverty Bay; Whakapunake (in the ranges) had a total rainfall of 16·27 in. for the month, which is believed to be the heaviest for that station for any month for the past seven years. The damp and dull weather was trying and unpleasant to animal-life. Cold and changeable conditions followed, and southerly gales on the 27th were succeeded by a remarkable high-pressure system. While the barometer was highest the weather was fine in the greater part of the Dominion, but on the east coast the weather continued cold and damp, with strong south-east winds, which were accounted for by a disturbance which hung on the edge of the anticyclone and in the neighbourhood of the Chatham Islands.

During the winter months we get the worst storms, but on the whole the wind is less than usual, and this July was no exception to the rule. Rainfall was also mostly below the average.

From America it is reported that observations of the sun show less heat has been radiated during the past seven months than usual, and icebergs in the Atlantic were earlier and more numerous than in former years. This opens up interesting questions concerning terrestrial conditions, and shows that the study of seasonal weather needs a very wide outlook.

—*D. C. Bates, Director.*

RAINFALL FOR JULY, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	6·34	19	1·36	5·96
Russell	7·58	17	1·64	4·26
Whangarei	7·78	17	2·30	8·33
Auckland	2·80	19	0·60	5·10
Hamilton	3·45	14	1·00	5·24
Kawhia	3·70	16	1·01	6·86
New Plymouth	5·65	16	1·64	6·35
Inglewood	6·54	17	1·62	10·23
Whangamomona	4·36	18	1·10	7·68
Tairua, Thames	5·94	15	0·94	5·15
Tauranga	4·53	13	1·60	5·12
Maraehako Station, Opotiki	3·76	13	0·76	4·45
Gisborne	6·67	23	1·87	5·21
Taupo	2·42	13	0·82	4·21
Napier	3·65	18	0·84	3·95
Maraekakaho Station, Hastings	5·40	22	0·97	3·83
Taihape	2·62	19	0·42	3·33
Masterton	5·49	26	1·37	4·43
Patea	2·98	15	0·56	4·10
Wanganui	1·32	8	0·33	3·63
Foxton	1·94	7	0·72	3·47
Wellington	3·77	19	0·71	5·73

RAINFALL FOR JULY, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	2·83	14	0·90	6·99
Greymouth	3·15	8	1·22	8·43
Hokitika	2·50	8	1·06	9·20
Arthur's Pass	4·25	1	4·25	12·53
Okuru, Westland	2·54	7	1·54	12·03
Collingwood	8·35	10	2·21	9·65
Nelson	2·56	9	1·20	3·53
Spring Creek, Blenheim	1·52	10	0·80	3·93
Tophouse	3·56	9	1·50	5·65
Hanmer Springs	2·74	11	0·64	5·15
Highfield, Waiau	2·50	15	0·52	2·42
Gore Bay	2·53	19	0·70	3·31
Christchurch	3·90	22	0·85	2·77
Timaru	1·82	11	0·52	1·95
Lambrook Station, Fairlie	0·82	6	0·40	2·72
Benmore Station, Omarama	0·50	6	0·16	1·74
Oamaru	0·96	13	0·25	1·78
Queenstown	1·38	3	1·05	2·01
Clyde	0·28	4	0·08	0·94
Dunedin	2·14	13	0·62	3·02
Gore	1·08	10	0·25	2·05
Invercargill	1·62	12	0·42	3·45

IMPORTATION OF GRASS-SEED FROM AUSTRALIA.

THE regulations issued in September, 1921, relating to the importation of grass-seed from Queensland and New South Wales with a view to the prevention of the introduction into New Zealand of ticks of the Ixodidæ family have been revoked, and other regulations gazetted on 2nd August. Under the latter provisions the importation of grass-seed grown in Queensland, or in the tick-infestation-quarantine area of New South Wales, is prohibited. Grass-seed grown in New South Wales other than in the tick-infestation-quarantine area, or in any other State of the Commonwealth, may be imported subject to the condition that prior to shipment to the Dominion it has been subjected to cyanide fumigation for a period of not less than six hours, or to other fumigation, in a manner approved of by the Minister, and, further, in the case of paspalum-seed, prairie-grass seed, and millet-seed, that it is again similarly treated upon arrival in the Dominion. No grass-seed is to be imported from the Commonwealth unless it is accompanied by a certificate signed by the consignor, in the form prescribed by schedule, and also by a certificate signed by an officer of the Department of Agriculture of the State in which it was grown, in the form prescribed.

IMPORTATION OF PLANTS INTO AUSTRALIA.

THE Commonwealth regulations designed to prevent the entry of fireblight-infected material into Australia have been modified, and the prohibition now applies to the following: "(*a*) All deciduous fruit-trees or parts thereof (including the fruit and seeds), and (*b*) all plants or parts of plants of the family *Rosaceae* (including the fruit and seeds), which were grown in any country in which pear-blight or fireblight (*Bacillus amylovorus*) exists: Provided that the Minister may permit the importation of new or special varieties of deciduous trees or their fruit or seeds, subject to any conditions which he may think fit to impose."

PRINCIPLES OF LIVE-STOCK BREEDING.

THE annual report of the Board of Agriculture for the year ended 30th April last states under the heading of "Principles of Live-stock Breeding":—

"During the year the Board has been giving a good deal of attention to this most important subject as a result of a communication received from the Franklin Agricultural and Pastoral Association. Several members of the Board, and the Department of Agriculture at the request of the Board, have collected a great amount of useful information. The papers prepared by the members of the Board, and also a most valuable one read at a meeting of the Board by Mr. W. D. Hunt, giving the results of his experience, have already been forwarded to the Franklin Association, and are attached hereto. At a later date, when additional reports on the subject which the Board is securing from abroad come to hand, it is the intention to prepare and publish a digest of all the papers for circulation to breeders in the Dominion. This will enable those interested in breeding in the Dominion to compare their practice with what obtains elsewhere, and ensure that sound principles are followed. This subject is more particularly interesting to stud-stock breeders, but nevertheless all farmers who are raising stock should have some knowledge of the principles of breeding, and the publication of this data should be of considerable benefit to them. Members of the Council [of Agriculture] and breeders generally are cordially invited to assist the Board in its investigations by submitting papers giving the result of their experience."

The papers referred to are by Sir James Wilson (including letters from the late James Little of Corriedale fame), and Messrs. Edwin Hall, W. Perry, D. Marshall, John Ewan, and, as mentioned, W. D. Hunt. The latter contribution is reprinted elsewhere in this issue under the title of "Breeding of Farm Animals."

EXAMINATION OF FERTILIZERS.

THE Department's Chemist would value the assistance of farmers in examining the quality of the fertilizers on the market. For this purpose a portion of fertilizer should be taken from each of a number of bags and the portions thoroughly mixed together. Finally, a portion weighing about 1 lb. may be put into a clean dry tin, and posted with the invoice certificate or a copy of it, addressed to the "Agricultural Chemist, Dominion Laboratory, Wellington." It is essential that the invoice certificate should accompany any sample sent. Senders of samples will note that under this arrangement the results of the examination cannot be supplied to them unless confirmed by an official sample. If it is possible and the results warrant it an official sample will be obtained by the local Inspector from the vendor's store.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society: Hastings, 17th and 18th October.
Poverty Bay A. and P. Association: Gisborne, 23rd and 24th October.
Marlborough A. and P. Association: Blenheim, 24th and 25th October.
Timaru A. and P. Association: Timaru, 24th and 25th October.
Wairarapa P. and A. Society: Carterton, 24th and 25th October.
Manawatu A. and P. Assn.: Palmerston North, 30th and 31st Oct. and 1st Nov.
Ashburton A. and P. Association: Ashburton, 31st October and 1st November.
Wanganui A. and P. Association: Wanganui, 7th and 8th November.
Canterbury A. and P. Association: Christchurch, 8th and 9th November.
Waikato A. and P. Association: Hamilton, 20th and 21st November.
North Otago A. and P. Association: Oamaru, 21st and 22nd November.
Stratford A. and P. Association: Stratford, 21st and 22nd November.
Otago A. and P. Society: Dunedin, 28th and 29th November.
Southland A. and P. Association: Invercargill, 11th and 12th December.
Feilding I., A., and P. Association: Feilding, 5th and 6th February.
Clevedon A. and P. Association: Clevedon, 9th February.
Dannevirke A. and P. Association: Dannevirke, 13th and 14th February.
Methven A. and P. Association: Methven, 27th March.

The New Zealand

Journal of Agriculture.

VOL. XXVII.—No. 3.

WELLINGTON, 20TH SEPTEMBER, 1923.

THE IDEALS OF A SOIL SURVEY.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

A NATIONAL soil survey is a method of classifying lands into groups and types in a manner which designs to express the relationship of one soil to another, and to indicate the relative value of each. One of the last stages of such a work is the demarking of boundaries of soil types in the form of a soil map. A soil survey therefore seeks to classify land with regard to its quality and usually takes place in settled country, while a land survey deals chiefly with the position of land and usually takes place in virgin country. A topographical survey is a land survey on a larger scale, giving details of surface contour, and showing the chief improvements effected by settlement, such as roads, bridges, and buildings.

The United States Department of Agriculture has among its several organizations a Bureau of Soils, which is charged with the duty of carrying out a soil survey of the American Union. In a little work issued by the Bureau the purpose of a soil survey is described as "to map, classify, correlate soils, to determine their field characteristics, to report on the actual use being made of the soils and on their adaptations to various crops so far as can be determined, and upon the relative productiveness of the several soil types." The Bureau

points out (1914) the value of such knowledge to the following classes of people: (1) Scientific men engaged in the investigation of problems relating to plant-production, to farm-management, to farm demonstration, to stock-raising, to problems of rural organization, to road-building—in short, to many branches of agricultural science; (2) the farmer; (3) colonists, colonization agencies, investors, development organizations, and individuals; (4) students of geographic, social, and economic sciences without reference to agricultural industries.

In the 1922 report of the United States Secretary of Agriculture it is stated (page 392) that the soil-survey work is the basis for the experimentation of the various State agricultural experiment stations. As a result of this classification of the soils varietal and fertilizer tests are being established on the large and important soil types of the United States. That the soil type possesses individual characteristics is becoming more and more recognized by the agriculturist, county farm adviser, and extension-service director. The peculiarities of the various soils must be considered if we are to make the greatest progress in plant breeding and selection, in fertilizer practice, in cultivation—in fact, in all work looking to improvement of cultivated crops.

THE BASIS OF CLASSIFICATION.

Every branch of natural science is dependent on some classification of the elements with which it deals before much progress may be made. In chemistry the discovery of the periodic law provided a scheme of classification into which all the known elements could be placed, and in which any future discoveries could be fitted. In botany and zoology schemes of classification based on the natural relationship of plants and animals have been indispensable to the study of those sciences, and in geology a classification based on the age of the rocks has been necessary. So, with soil science—at present in its infancy—it is equally necessary that some scheme of classification should be adopted.

The character which both the British and American authorities are agreed upon accepting as the key to the classification of soils is the size of the particles, and the proportion of the differently sized particles which make up a soil. Hall and Russell, the Rothamsted agricultural chemists, recommend that for the purpose of a survey a large number of soils should be submitted to mechanical analysis, including the determination of the organic matter and of calcium carbonate, and that then a carefully chosen representative set should be analysed chemically so as to characterize the type; these can further serve as standards with which farmers' samples can be compared by the citric-acid method of determining available plant-food. These English authorities agree with Whitney (Chief of the United States Bureau of Soils) that mechanical analysis should form the basis of the survey, because it alone takes into account those physical functions—the regulation of the water-supply and therefore of the temperature, of the air-supply, and of ease of cultivation, &c.—that play so large a part in determining the value of a soil. This method of classification is, however, not applicable either to chalk

(limestone) or to organic soils. These exceptions occur so rarely that no difficulty will be encountered in New Zealand in adopting soil-texture as a basis of classification.

Soil-texture in all but humus soils is governed by the size of the inorganic (mineral) particles composing the soil. The nomenclature of these particles is framed on words in common use, but it must be remembered that in soil science they have a definite meaning, and that each term refers to particles of a size varying within definite limits. The coarsest of these particles is termed gravel, and the other sizes are, in the descending order, called sand, silt, and clay. The first three are further subdivided into fine and coarse fractions. These terms are sufficiently explanatory to enable one to denote the method of allotting a name to any given soil. That sized fraction which is present in greatest amount gives its name to the soil, and those fractions which are present in still large amounts but less than the largest give (where present) their name as a qualifying adjective. Thus a soil may be called a fine sandy clay, gravelly sand, or a sandy silt. When only one fraction predominates it is, of course, necessary to use only a simple term to describe it. The dune-sands of the coast are therefore merely "sands." This may seem so obvious as not to need the telling, but it is necessary to caution readers that although the terminology of soils is commonplace it is not loosely used. A "sandy silt" not only means that the soil is composed of particles of definite size (within certain limits) to which the words "sand" and "silt" have been allotted, but that the silt predominates in quantity over the sand, and that both occur in the proportions to which that compound name has been allotted. The determination of the proportion in which the differently-sized particles occur is the somewhat lengthy operation of the chemical laboratory known as mechanical analysis or physical analysis.

In the United States it is the practice to prefix a locality-name to the soil-name, indicating the type thus—for example, "Orangeburg fine sand" and "Susquehanna clay."

MAPPING OF SOILS.

Having shown how soils are classified it is necessary to show how their distribution is put on record. This may be done in various ways, but the best is by means of a soil map indicating by various colours the sites of the different types. The presence of certain types sometimes may be inferred by the system of plant-indicators. This method is based on the fact that in some countries certain plants are characteristic of certain soil types and are not found elsewhere in the same abundance or luxuriance. Hence the vegetation is in some cases a guide to the soil. Minerals—mica or calcic carbonate, for instance—occasionally may be used as indicators. Lastly, when the parent rock from which the soil was derived is known the soil may be indicated by that means.

A soil survey may be one of three kinds :—

(1.) A flying soil survey, which aims at making a rapid examination of the soils of a district with a view to discover the main types which occur, and to describe them. This method is suited to country in the virgin state and when covered by virgin vegetation. An example is

the writer's survey of the Auckland Islands (1907), in which it was found possible to correlate the main types of soil with reference to the natural vegetation (see this *Journal* for January, 1911).

(2.) A reconnaissance soil survey, which is a more careful examination with a view to a detailed survey later.

(3.) A detailed survey, which can only be undertaken with the aid of a good base map on a scale sufficient to show the situation and extent of each type when the area is mapped.

Accurate mapping is not attempted in the first two kinds of survey. In these it is sufficient to give such information, be it of topography, appearance of soil, or plant covering, which will enable the man on the land to recognize the soil types by mere description. In the detailed survey the farmer is not put to the trouble of identifying soil types from description, but only has to identify the position of his soil on the map.

In the United States the soil surveyor is provided with a base map of one-mile-to-the-inch scale. Each section or square mile is divided into 40-acre plots on the map, and the surveyor must inspect every 10 acres and determine the type or types of soil composing the section. The different types are indicated on the map in different colours. The samples are drawn for inspection, and, if necessary, for analysis, by means of an auger which may be lengthened to reach subsoil depths. A method of checking the accuracy of the work in the field is for two men to operate on adjoining strips of land, and if the work is done correctly the soil-type boundaries will correspond on the line between the strips.

The largest unit used in classifying the lands of the United States is the soil province, which is subdivided into the soil series, which are again divided into the smallest unit, the soil type.

The soil province is a large area of country, not necessarily massed together as the word "province" might seem to imply, but of odd shape, often straggling over huge areas of territory or existing even in disconnected stretches or patches of country. The soil provinces of the United States are some fourteen in number, and owe their individuality to varying causes, some being defined from geographical position, some on geological, and some on climatic grounds. Thus the flood-plains of the great rivers flowing into the Gulf of Mexico are a soil province, the glacial lake and river terraces are another, the limestone uplands and valleys are a third, the Rocky Mountains and plains are a fourth, the arid South-west a fifth, and so on.

EXAMPLES OF AMERICAN AND EUROPEAN PRACTICE.

When the soils of a province have a common origin, differing only in texture, and are alike in colour and physical properties other than those affected by texture, this collection of soils is termed a soil series, and these are arranged, according to texture, into soil types. Thus in the glacial and loessal* soil province, which includes the State

*Loessal material means material deposited by wind.

of New York, we have the Miami series, which comprises fourteen types of soil, ranging from Miami stony sand (the coarsest texture, of which there are 100,000 acres) down to the Miami clay loam (the finest texture, of which there are nearly 2,000,000 acres).

We learn that the Miami series is one of the most widely distributed and complete soil series that has been established. The series is characterized by the light colour of the surface soils, by derivation from glacial material, or by being timbered, either now or originally. The heavier members of the series are better adapted to wheat than the corresponding members of the Marshall series, but they do not produce as large yields of maize. The clay loam is the most important for general farming, and forms the principal type of soil in western Ohio and central and eastern Indiana. It is especially well adapted to small grain and grass crops. The silt loam is more rolling and hilly than the clay loam, and is not so well suited to general farming. Wheat does better upon it than upon the Marshall silt loam, with which it is closely associated, but the yields of maize are considerably less. It is also well adapted to fruit, especially apples. The sandy loam and fine sandy loam are used for general agriculture, but are especially adapted to medium and late market-garden crops and fruit. The loam is suited to maize and potatoes, while small grain and grass are grown, but with less success than upon the clay loam. Strawberries and raspberries, as well as other small-fruits, do well on this type. The stony sand, gravelly sand, and gravel are not of much agricultural value under present conditions. The stony loam is a good general-farming soil, is also well adapted to apples, and furnishes excellent pasture, while in New York lucerne is grown upon it very successfully. The stony sandy loam and gravelly sandy loam are not strong soils, but are fairly well suited to light farming, fruit, and market-garden crops. The sand and fine sand are not adapted to general farming, but are the best early market-garden soils of this section. Such is a brief example of an American soil survey and its application in a most closely settled rural area.

Sir A. D. Hall considers that only by comparison with the type soil can the analysis of any particular soil be interpreted. The fact that a soil from a given arable field contains 0·15 per cent. of phosphoric acid takes a very different aspect when it is known that the soils of the same type contain as a rule 0·18 to 0·20 per cent., particularly if also the response of that kind of land is known by field trials or from the accumulated experience of farmers.

The importance of a soil survey in an old and closely settled country like England is different from that in a comparatively new country like the United States or New Zealand. The importance in the older country is largely in its application to the saving of the manure bills of farmers by their adoption of more efficient fertilizers. "By having the requirements of their land made known to them, enormous economies might," says the last-quoted authority, "be effected in the bills of almost every farmer using artificial manures, if the latter were properly adapted to his soils and crops." He concludes that it is not too much to say that the information as to manuring which is being accumulated at

many experimental centres throughout the country can only be rendered properly available by the execution of a soil survey in the district under consideration.

The United States stands foremost in the extent of its soil-survey activities, but in some other countries, notably Prussia, Belgium, and France, soil survey is by no means neglected. A beautiful example of the latter country's work is copied into the *Journal of the Ministry of Agriculture* (England) for April, 1920, page 57. The map is roughly on a sixth-of-a-mile-to-the-inch scale. The different geological formations are shown in different colours, and on each is inserted a parti-coloured disk-shaped portion, the colours of which correspond to the legends "organic matter," "chalk," "clay," and "sand," while the size of each colour corresponds to the proportions of those ingredients present in the soil. Another figure of rectangular shape gives at a glance the proportion, expressed as parts per thousand in the soil, of nitrogen, phosphoric acid, potash, and lime. In this map, indicating about four square miles, there are depicted four geological formations, and on them are indicated the results of eight mechanical analyses and thirty chemical analyses.

A NEW ZEALAND ILLUSTRATION, AND THE MATTER OF COST.

Applying the American method of soil survey to the lands of our Manawatu coastal area, as a hypothetical illustration, we might have —(1) The Tararua series, consisting of the soil types—gravels, river-sands, loams, and clays—derived from the greywacke rock of the Tararua Range, and combinations of these; (2) the littoral series, consisting of the dune-sands of the coastal plain, and combinations with various amounts of organic matter; (3) the Manawatu series, consisting of the clays and silts of the Manawatu River flood-plain, and combinations of these with organic matter; (4) the Otaki series, consisting of the terrace lands overlying the old Otaki sandstone; (5) the organic series, consisting of those swamp soils the peaty nature of which has dominated all other constituents.

All the rivers between Paekakariki and the Manawatu River, having their sources in the Tararua Range, would therefore deposit mainly the Tararua series of sediments, but the Manawatu River, drawing its suspended material from many other sources, and the material differing largely in nature, warrants the allotment of a different soil-series name to its flood-plain.

The foregoing is a very rough sketch of a basis for classifying the Manawatu lands. The writer has endeavoured to place the series in the order of their relative importance. In mapping the country the difficulty will be to define the boundaries where one type by admixture imperceptibly shades off into another type. The mechanical analysis has always been used by this Department in classifying soils, and was so used in the Manawatu soil investigations (see *Journal*, Vols. xx and xxi).

In 1905 more than 20,000 square miles had been surveyed by the United States Bureau of Soils, with the aid of forty-five assistants,

at an average cost of $2\frac{1}{4}$ dollars per square mile, not including travelling-expenses. Later costs have been quoted by the same organization at 4 dollars per square mile. Still later no mention is made of the cost. Apparently the value of the work has established itself in the minds of the farmers, and the expense is no longer of interest to them. It is not likely that a detailed soil survey of New Zealand lands could be made at anything like the cost per unit of area to the United States, whatever it may be at present. In that immense country very large areas occur having a uniform soil origin and structure. The average cost of surveying such a country per square mile must always be small compared with that for comparatively small islands like New Zealand, where change of soil type is frequent, large-scale maps non-existent, and the surface extremely variable.

CONCLUSION.

The writer's opinion is that for New Zealand a complete soil survey will come in time, but that much good can be done in the meantime by means of a reconnaissance survey by which one may gain a knowledge of all the types existing, and may describe without being able to map them. By such means a soil survey may be begun, and the descriptions of types should be intelligible to the local scientific officers of the Department. Although it might not be possible for them to delimit the boundaries of types, and say just where one soil ends and another begins, it should be possible in typical cases to recognize types. At present, except in pressing cases, the detailed soil survey of New Zealand will be made to coincide with the topographical survey which the Lands Department is executing. Approval has been given to the resumption of the North Island reconnaissance soil survey interrupted by the war and since delayed for financial reasons.

No systematic soil survey has been undertaken of the soils of Great Britain, but several most readable treatises have been published on the soils of certain districts. Chief among these is Sir A. D. Hall and Sir John Russell's delightful "Agriculture of Soils of Kent, Surrey, and Sussex" (1911). Others are G. W. Robinson's "Survey of the Soils and Agriculture of Shropshire" (1912); Dr. Luxmore's "Soils of Dorset"; Goodwin's "Soils of Nottinghamshire"; L. F. Newman's "Soils and Agriculture of Norfolk"; and lastly the memoir of Mr. T. H. Rigg (formerly of this Laboratory and now of the Cawthron Institute, Nelson) on "The Soils and Crops of the Market-garden District of Biggleswade" (1916). The first two named of these surveyors take a most comprehensive view of their duties, and produce works of value to the historian and rural economist. In the American publications we miss those milestones on the road which a race creeps by to greatness. To quote a few lines from Robinson: "In Shropshire, at the time of Domesday, land had a mean annual value of about 2d. per acre. A horse was worth something of the order of 10s., an ox 30d., a cow 20d., and a slave £1. There were about 25,000 slaves in Shropshire who had no legal rights whatever."

It is to be hoped that when New Zealand soil surveys come to be written they may be as true a record of rural history and craft as those to which the British authors have set their names.

THE GRASSLANDS OF NEW ZEALAND.

SERIES II. THE TARANAKI BACK-COUNTRY.

E. BRUCE LEVY, Biological Laboratory, Wellington.

1. FOREST SUCCESSIONS.

THE hill country of New Zealand that has been cleared of forest or that still carries forest has been neglected too much in the past from a grassland-research point of view. Millions of acres of forest have been felled and grassed more or less haphazardly. Those areas which could be stumped and ploughed are among the richest of our grassland areas, but of the unploughable forest lands, out of 11,000,000 acres felled and surface-sown with grass, nearly 4,000,000 acres have reverted to scrub and fern, and this state of reversion is by no means stationary, 500,000 acres having been added to the total, according to official statistics, during the past four years. When it is thus remembered that every year during the past four years some 125,000 acres of our hill country have gone back to secondary growth it will be realized that money spent on research work on that country is amply justified. Every acre of such country that reverts to secondary growth means an average expenditure of fully £2 per acre to clean up and resow, making for each year an expenditure by the hill-country farmers of, say, £250,000 if the deterioration is to be stayed.

The writer hopes to be able to prosecute research more and more closely on our hill country generally, and operations have already been begun in the Whangamomona County. This work is being carried out in co-operation with Mr. J. W. Deem, chief Fields Division officer for the district, and with the assistance of Mr. A. J. Glasson, Fields Instructor in Taranaki. As the work proceeds, the results will be recorded from time to time in the *Journal*, and it is intended that the present article shall be the first of a series appertaining to the country in question.

The Taranaki back-country is decidedly hilly. Geologically speaking, the country is of recent origin, raised up as a great plain from the ocean depths. Upon the surface of this upraised plain nature has plied with its tools—rain, frost, and running water—and has sculptured out the present land-form. The streams cutting down have left the ground unevenly raised, in some places as small or large hillocks, and in other places as hills ranging in varying heights up to 500 ft. or 600 ft. Some of the hills are extremely steep, meeting at the base in narrow V-shaped ravines; others are more gently sloping, often with intervening valleys aggraded so that small areas of flat are formed between the slopes. The hills themselves vary from being bluntly or sharply razorback to easy rolling convex surfaces. From any point of the highest ridges—1,300 ft. above sea-level—the country looks like a billowy sea as hill after hill rises in wave-like regularity, lighted and shaded according to its disposition to the sun. The whole land-form—hills of various

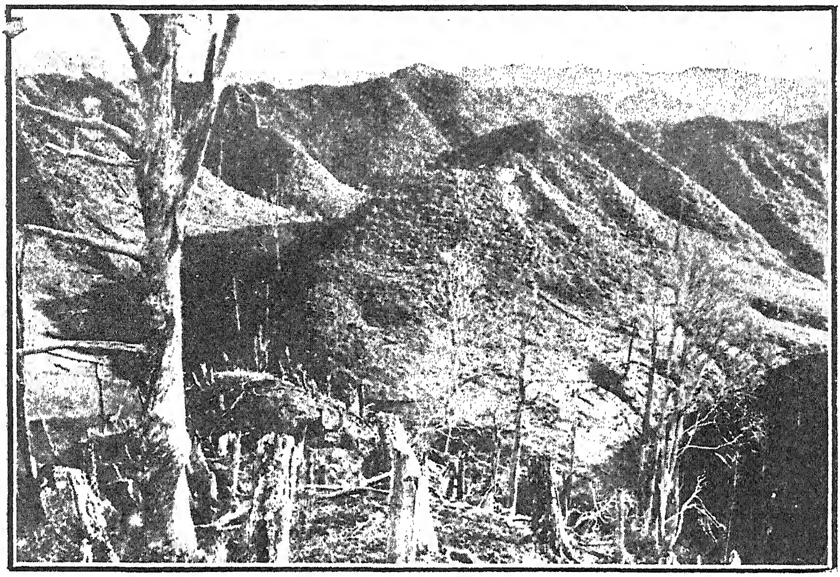


FIG. 1. THE HILL COMPLEX, SHOWING SOME CHARACTERISTIC FEATURES.

In the background are bluntly razorback ridges with rather easy sloping foothills. The foreground is exceedingly steep; the stumps seen are mainly those of kamahi; the standing dead tree on the left is totara.

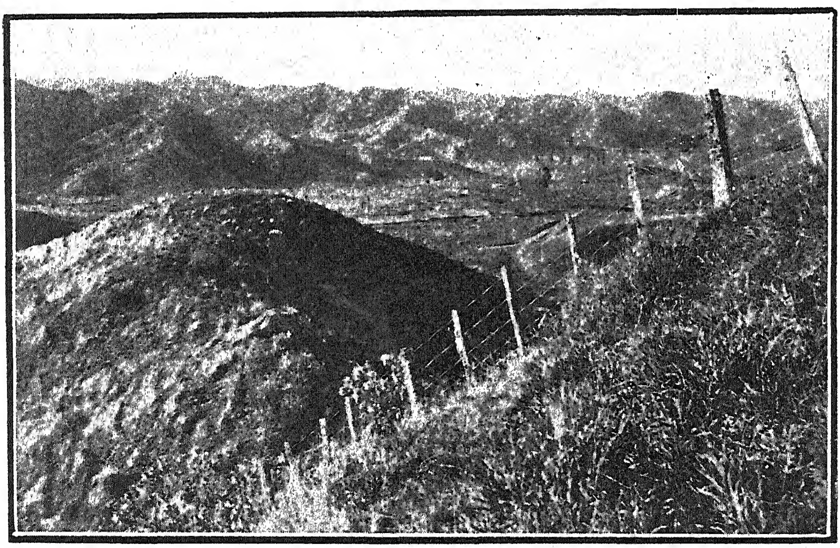


FIG. 2. ANOTHER VIEW OF THE HILL COMPLEX.

Showing in the foreground a steep well-grassed ridge and easy sloping hillock; in the middle distance is an aggraded flat; and beyond, the steeper and more rugged country.

[Photos by E. B. Levy.

heights and shapes, with the intervening ravines and small aggraded flats—we may call the "hill complex" (Figs. 1 and 2).

The surface soil is a light, friable, chocolate-coloured loam; the subsoil is either sandstone or blue papa. The sandstone formation may often be seen lying on top of the papa at the junctions of the two great subsoil formations. Here often a layer of sandstone alternates with a layer of blue papa, telling the geologist in his own language of oscillations of the sea-floor prior to the uplift which decided that thenceforth only sandstone would be deposited instead of the deep-sea deposit of blue papa. In the two subsoil formations, but more particularly in the sandstone, pockets or seams of a fairly hard pebble-and-shell conglomerate occur. This "shell rock" is quarried and used as road-metal.

The two classes of subsoil are held by the local farmers to have quite different agricultural possibilities, that of blue papa being considered superior in quality to the sandstone. Nature, in the great forests it has produced on these classes of soil, has differentiated scarcely at all between the two. The forest cover is, in the main, similar throughout both formations.

TYPES OF FOREST.

In view of the fact that the forest is a valuable index in deciding which grasses and clovers are the most likely to be successful in the establishment of grassland on these soils, a short description of the forest, particularly from the point of view of the disposition of its species in regard to the various aspects of the country, will be of considerable value. Tawa is essentially the dominant primary-forest tree (Fig. 3). If we start from the small flats and gradually rise up to the highest ridges we pass through a sequence of forest-growth. On the small aggraded flats between the slopes (Fig. 2) kahikatea (*Podocarpus dacrydioides*), rimu (*Dacrydium cupressinum*), and pukatea (*Laurelia novae-zealandiae*) predominate; but as the ground begins to rise, so tawa (*Beilschmiedia tawa*) comes in, and on the lower levels and in the gullies it is associated with rimu, miro (*Podocarpus ferrugineus*), matai (*Podocarpus spicatus*), and maire (*Olea Cunninghamii*). The rimu, miro, matai, and maire become increasingly fewer as we ascend, and almost pure forests of tawa are met with a short way up the slope. Within the rimu, miro, matai, maire, and tawa forests tree-ferns are abundant, particularly the weki (*Dicksonia squarrosa*) and hemitelia (*Hemitelia Smithii*); and in the drier parts the mamaku (*Cyathea medullaris*) rises gracefully through an opening in the forest-roof. Within these forests also the floor is, in the main, covered with terrestrial ferns. Weki extends well up into the tawa forest, but here the general forest-floor is more or less free of ferns or other growth, with the exception of the graceful single crape fern (*Leptopteris hymenophylloides*), which may be abundant.

As we climb higher up the slopes and get on to the poorer and higher ridges the tawa becomes intermingled with kamahi (*Weinmannia racemosa*), hinau (*Eloeocarpus dentatus*), rewarewa (*Knightia excelsa*), rata (*Metrosideros robusta*), and totara (*Podocarpus totara*); then higher up still, on the poorest and driest ridges and knolls, the tawa almost disappears, and black-beech (*Nothofagus Solandri*) there

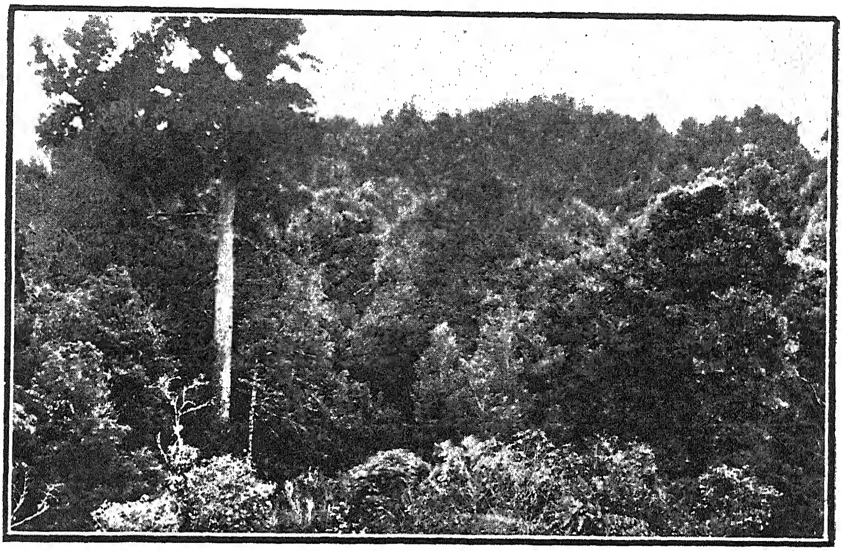


FIG. 3. THE PRIMARY FOREST.

Tawa is dominant, but associated with it in minor associations are kamahi, rewarewa, hinau, miro, maire, and rimu. The tall tree in the foreground to the left is rimu.

FIG. 4. SHOWING PRIMARY AND SECONDARY FOREST.

Primary forest (in background) on steep, poor ridge—rewarewa, tawa, kamahi, hinau, rata, black-beech. Secondary forest in foreground—tutu, tupari, wineberry, tree-fuchsia, cdd manuka, kamahi, tingahere, and karamu.

[*Photos by E. B. Levy.*

predominates (Fig. 4). These groups, then, comprise essentially the primary forest, and they are of immense significance, as will appear later, in deciding the varieties of grasses and clovers that should be sown. The foregoing is an account strictly appertaining to the ancient forests, which are here termed the "primary forest."

Where there have been factors at work that have destroyed the primary forest within the last hundred years an altogether different growth has come into being, varying in its components and from the primary forest according to the longer or shorter time that has elapsed since that destruction, and according to soil and aspect. Such growth may be in the form of fern or scrub of different sorts, or it may consist of small trees. Both classes of growth must be regarded as developmental stages by which the primary forest may once more re-establish itself. To the fern and scrub may be applied the term "secondary scrub," and to the small tree associations that of "secondary forest." The primary forest is really the aged adult; the secondary scrub and the secondary forest are but phases in the life-cycle or processes of growth leading to the adult primary forest. Here, then, we find in natural vegetation, as in our grasslands, that there is succession—that is to say, there is a series of plant communities, one type by its growth preparing the way for the next, which when established will replace its foster parent. The latter in its turn will grow—it will again modify the conditions so that a still higher class of forest-growth may establish, and this, too, will ultimately be replaced by a still higher forest-form. And so the succession of forest types goes on until finally there arises an association that ceases to change. This stage is old age; it is the climax of a gradual development. It is called a "climax association." Development, of course, never stops in nature, but the change after a shorter or longer time becomes so slow that for all intents and purposes the scenes have ceased to change.

Actually it would appear that in the Whangamomona district there were only two climax trees—tawa on the slopes and kahikatea on the wetter flats. On the slopes, then, all the other primary-forest trees present would be looked upon as preparing the way for the tawa climax, and we could tentatively arrange them in the following order of development: Black-beech, totara, kamahi, rewarewa, hinau, maire, rimu, rata, tawa. The present disposition of the trees as they appear in the primary forest supports this order of development. Where there are old and often knarled totara, black-beech, rewarewa, &c., we find the undergrowth not to be young trees of these species (though some young rewarewa may establish there), but sapling tawa growing strong and vigorous (Fig. 5). We find that the rata are, in the main, well up on the ridges—the survivals, apparently, of a general rata retreat before the tawa advance. The great forest-tree that supports the rata in its juvenile stage is the rimu, and consequently it may be inferred that a rimu association preceded that of the rata, or else the rata could not have developed into the large forest-trees seen on the ridges. As far as the regeneration and development of the primary forest is concerned, the black-beech now plays no part on the lower slopes. The beech, then, would appear to be either the survival remnant of a once high-altitude forest, or else the remnant of the first forest that clothed the lowland, but which for ages has been located on

the poorer ridges, this habitat being maintained because the processes of weathering and of plant-decay which have made soil for the lowlands are rendered null and void, owing to the fact that the waste is removed down to the lower levels almost immediately it is formed. Thus on the ridges there is virtually continually exposed the original dry, rocky-soil material which characterized the surface countless ages ago, while the lowland soils have been so improved and added to that other forest-trees have been able to oust the beech entirely from these soils.

As the beech is the remnant of a physiologically dry-condition forest, so the kahikatea is the remnant of a low-lying, wet-condition forest. Development on a stationary land-surface, it would appear,

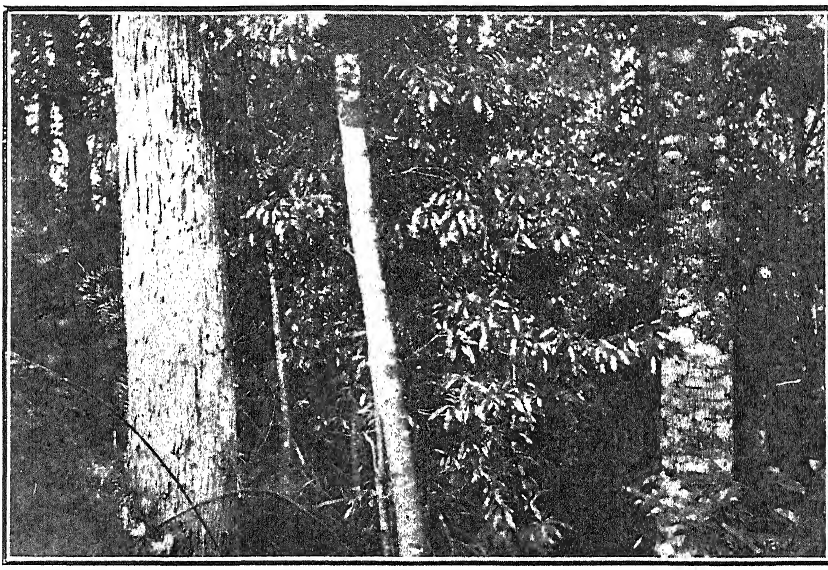


FIG. 5. PRIMARY FOREST OF THE TOTARA, REWAREWA, KAMAHI, BLACK-BEECH TYPE IN PROCESS OF BEING REPLACED BY TAWA.

The tree-trunks to the left and to the right respectively are totara and beech. The sapling-trunk and the willow-like foliage are those of young tawa.

[*Photo by E. B. Levy.*

all tends towards the middle or average state—*i.e.*, that state, as far as moisture content is concerned, midway between the physiologically dry-condition forest, on the one hand, and the wet swampy forests of the flats, on the other hand. The tawa is essentially a tree admirably suited to the moderately wet soils, and thus essentially suitable to form the forest climax. One other fact that supports the contention of the tawa climax is that tawa forest can reproduce itself *in situ*, the young tawa establishing well in the shade of the parent forest-tree. There are very few other forest-trees capable of reproducing themselves in this way. Kahikatea, miro, rewarewa, and hinau may successfully establish in their own shade, but most of our forest-trees—rimu, rata, kauri, beech, kamahi, &c.—demand more light than penetrates to the

floor for the successful establishment of their seedlings; consequently such forests must have open land bordering them into which they can extend, or else depend for their continued occupation of the soil on their ability to compete for the bared ground rendered available for occupation on the death of a parent tree. Of those trees mentioned earlier only the beech seems capable of doing this.

In making tawa the climax forest-tree of the Taranaki back-country I am confirming the work of Cockayne,* who states: "Tawa forest may, I think, be considered the final stage in the series of succession forming taxad forest; that is to say, whenever it occurs one may conclude that forest rich in taxads previously occupied the ground. In support of this view, all degrees of intermediate stages exist between the rimu and tawa forests."

THE ORDER OF DEVELOPMENT OF SECONDARY SCRUB AND SECONDARY FOREST ASSOCIATIONS.

In the initial grassing of the hill country under consideration there is an incessant struggle against secondary-scrub growth—water-fern (*Histiopteris incisa*), bracken-fern (*Pteridium esculentum*), manuka (*Leptospermum scoparium*), wineberry (*Aristotelia serrata*), &c.—which types of vegetation constitute really the first phases in the succession back to forest. Nature all the time is endeavouring to win back the area to forest, and in a district of fairly good soil and heavy rainfall the advantage is all with the secondary growth. In the Taranaki back-country there is no set of grasses at present known that could be used which in themselves would be sufficiently strong and aggressive to annul the great tendency of that country to revert to secondary growth. The all-important factor of stocking must come in to assist the grasses sown.

It is the writer's intention, before actually considering the suitable pasture species and their establishment and management on this country, to set out in a fairly detailed way the type of secondary scrub and secondary forest one meets with, and to show how every type of vegetation that arises is part of nature's plan to afforest once more those denuded hill-slopes. In other words, the succession from the forest-burn back to standing primary forest will be considered step by step. This study is important because if we know the sequence of events and the consequences of a certain method of treatment, then are we the more able successfully to avoid that which is undesirable and attain that which is desirable. Where the objective is good grassland, nature has to be combated at every turn, and as we consider the types of secondary growth that arise under different farm-management it will be seen that she is by no means a mean adversary. The grassing of forested hill country is a man's job, and too seldom do we realize the grit, perseverance, and foresight displayed by our pioneer settlers who have struggled and won against great odds.

A succession normally begins with a bared surface—termed the "initial surface"—and it presupposes that all or most of the original plant cover has been destroyed. This is so in the case of the settler's forest-burn. The forest is felled in the winter or early spring and left

* L. Cockayne, *The Vegetation of New Zealand*, Leipzig, 1921, p. 139.

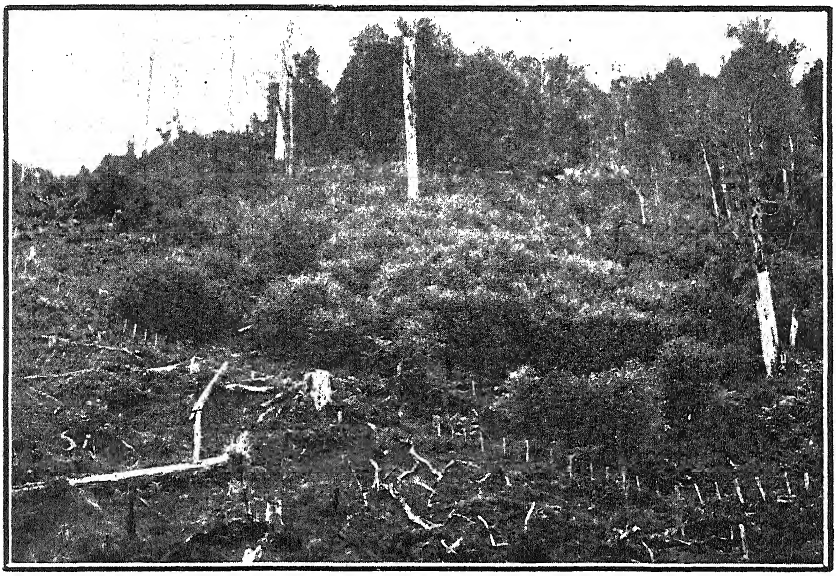


FIG. 6. WINEBERRY FORMING THE FIRST PHASE OF THE SECONDARY FOREST.

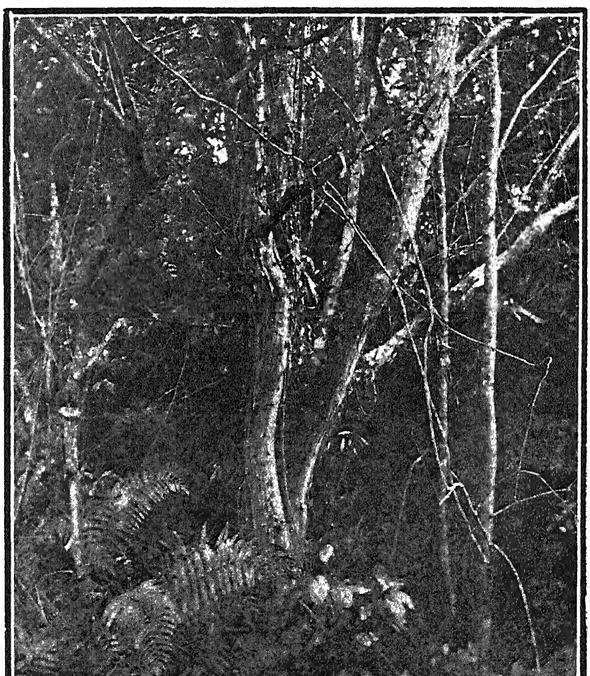


FIG. 7. TREE-FUCHSIA, TUTU, AND LACEBARK IN THE FINAL STAGES OF THE FIRST SECONDARY-FOREST PHASE.

Note the ferns and other growth on the floor, leading up to the final phase of the secondary forest.

[Photos by E. B. Levy.

to dry until the following autumn. If the season is settled, the later the burn can be left the better. The seeds are sown on the ashes even while these are yet warm. In addition to this sowing there is another set of seeds well and truly planted on the forest-burn. These latter may be spoken of as "volunteers." They consist largely of indigenous species—some seeds, some spores—and also of certain wind-borne introduced species, such as spear-thistle (*Carduus lanceolatus*) and catsear (*Hypochoeris radicata*). For the first two or three years there may be a dense volunteer association of spear-thistle, and, where the grass has failed to take, the rosettes of catsear may form, even in the second year, a pure association. So long as the spear-thistle does not grow too rank or dense there is not much harm done to the grass sward, but if the big rosette plants form so that the turf becomes much shaded there is bound to be damage.

In the third and fourth years the native plants begin to manifest themselves, and particularly is this true if the take of grass has been poor or has quickly run out. A reduced grass cover means the withdrawal of stock, and it must be remembered that stock is the biggest factor in secondary-growth control. So long as we can keep stock in fairly large numbers on the area there is scarcely any danger of secondary growth. Thus the stocking of the new forest-burn will have a very decided influence in determining just what secondary scrub establishes.

THE SUCCESSION ON A BADLY BURNT AREA, UNSTOCKED.

If a burn is such that only a very poor take of grass is possible there is not the same establishment of catsear or spear-thistle. The area cannot be heavily stocked, and fern and scrub growth immediately makes its appearance. Weki also may grow out afresh from their unburnt trunks. Water-fern is the most characteristic fern of these bad burns, but soon there comes to be associated with it wineberry, lacebark (*Hoheria populnea*), tree-fuchsia (*Fuchsia excorticata*), and tutu (*Coriaria sarmentosa*). On the poorer ground there is not so much water-fern, and wineberry, lacebark, and tree-fuchsia may be absent. Bracken-fern and tutu here come in. In steep shady places there may be large masses of tupari (*Blechnum capense*), while on the open sunny knolls kamahi may re-establish. The bracken-fern phase and the succession from this point will be considered later.

In the early secondary-forest growth following on a bad burn wineberry is easily the leader, and it may form quite a dense association from an early period (Fig. 6). Tree-fuchsia and lacebark really come in a little later than the wineberry, but the three ultimately intermingle to form the first secondary-forest phase of the succession back to primary forest. As the wineberry, tree-fuchsia, lacebark, &c., raise their branches higher a certain amount of light filters in on to the floor, and so soon as this happens further species of trees establish (Fig. 7). Mahoe (*Melycitus ramiflorus*), karamu (*Coprosma robusta*), kanono (*Coprosma grandifolia*), rangiora (*Brachyglottis repanda*), hangehange (*Geniostoma ligustrifolium*), patete (*Schefflera digitata*), fivefinger (*Nothopanax arboreum*), red-pepper tree (*Drimys colorata*), lancewood (*Pseudopanax crassifolium*), tarata (*Pittosporum eugenioides*), kohuhu (*Pittosporum tenuifolium*), kaiku (*Parsonsia heterophylla*), and kaikomako

FIG. 8. A MASS OF PIRIPIRI ON A FIVE-YEAR-OLD BURN STOCKED SOLELY WITH SHEEP.

FIG. 9. HARD FERN (IN CENTRE) ESTABLISHED AND SPREADING OVER A DRY KNOLL IN A RECENT BURN.

Note the catsear occupying the remaining portion of the knoll, and, towards the top of the photo, piripiri.

[*Photos by E. B. Levy.*

(*Pennantia corymbosa*) are among the most common trees that come in. Moisture- and shade-loving ferns such as *Asplenium bulbiferum*, *Goniopteris pennigera*, &c., also make their appearance. It is to such an association that is here given the term "secondary forest." It is essentially a shady and fairly moist forest, and, unquestionably, conditions in such a forest are entirely propitious for the establishment of the primary-forest trees. What is more, it is here that certain of the forest-trees establish, and it is not until these conditions arise that such trees as tawa or miro can successfully do so. Kahikatea and rimu also may establish here, but these can and usually do establish very well in much more open secondary forest, as will be mentioned later.

The foregoing is essentially the normal process of regeneration on the better soils and under no stocking whatsoever. We may with safety look upon any soil that goes through a dominant wineberry-lacebark-mahoe phase as being good potential grassland soil. Such is the succession in the gullies and better slopes of the Taranaki back-country.

SUCCESSION AFTER A GOOD BURN AND WITH LIGHT STOCKING.

Reverting back to the forest-burn, and presupposing a clean burn and a fairly successful take of grass, spear-thistle and catsear, as before mentioned, occupy their quota of ground. On the bare knolls also piripiri (*Acaena Sanguisorbae*) will have successfully established, and if the area felled was forest into which sheep have had access, or if the burn has been stocked in the first year with sheep from piripiri-infested areas, then this plant may be very common on all the drier knolls where the grass has failed to take. If such a piripiri-infested burn is stocked entirely with sheep, so soon as the grass surrounding the drier knolls is eaten bare the piripiri will spread, and in five or six years under constant sheep-grazing an almost pure association of this plant will have resulted (Fig. 8). Under cattle or mixed stocking it does not spread, and is gradually reduced until it virtually disappears. Hence on cattle-country it takes no part in the succession.

In the second or third year of the new burn, in the shade of logs and around stumps, water-fern and hard fern (*Paesia scaberula*) establish themselves. Hard fern also occupies dry knolls, establishing firstly in some shady crevice or niche of the knoll (Fig. 9), and then spreading outward by means of its wiry overground runners. Stock do not care for these two plants, and no matter how hard-pressed they may be they will not eat hard fern. At fairly high altitudes where there is more rain water-fern may form, under light stocking, an almost pure association. Hard fern, however, is the more important one as far as natural afforestation is concerned. Stock do not eat it, and once it gets well established and just so long as the area is kept stocked and the grass thus kept short the hard fern will spread. Ultimately the clumps will have so enlarged and the feed be so reduced that all stock, practically speaking, are forced off the area (Fig. 10). In this hard-fern association, then, we have a very decided phase in the succession to forest.

While the spread of hard fern has been going on, and particularly under sheep-stocking, the next phase in the succession has commenced. Bracken-fern, under light stocking, makes its appearance in

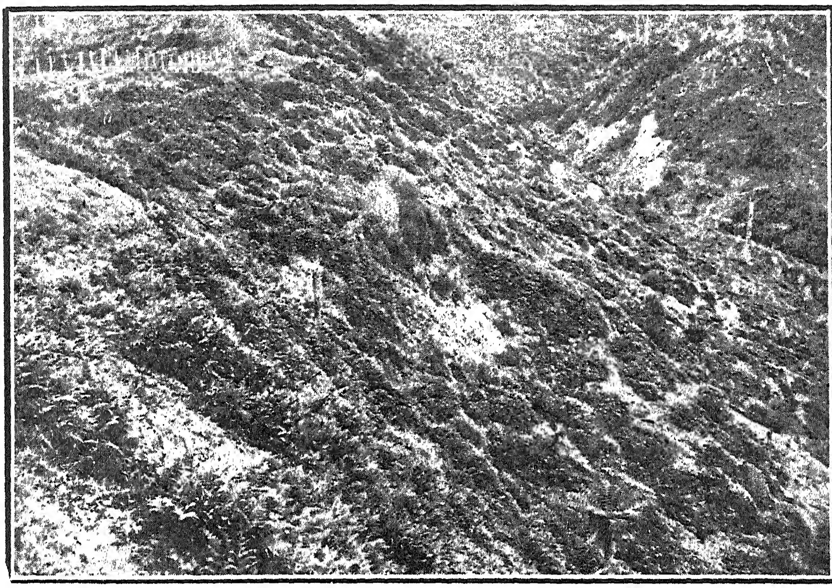


FIG. 10. THE HARD-FERN PHASE IN THE SUCCESSION.

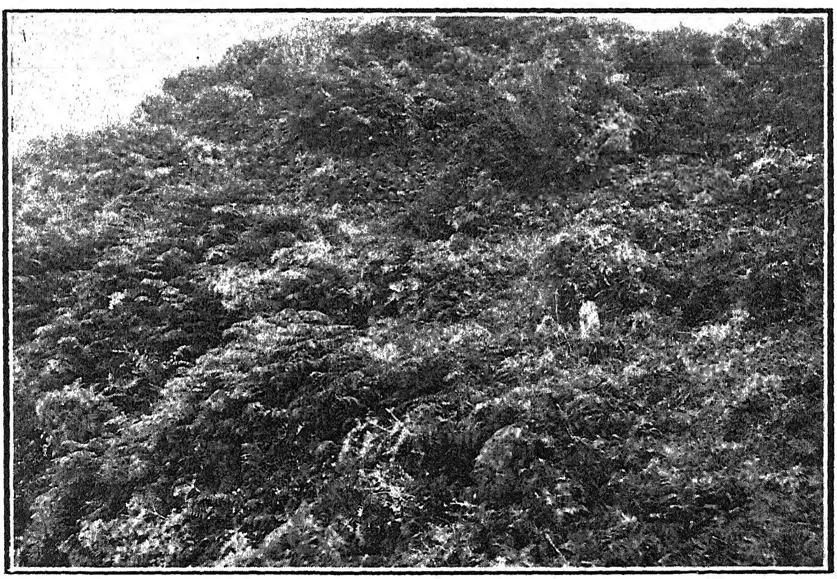


FIG. 11. HARD FERN ON A LIGHTLY STOCKED AREA BEING REPLACED BY BRACKEN-FERN.

In nearly all hard-fern patches on this slope the bracken was well established.

[*Photos by E. B. Levy.*

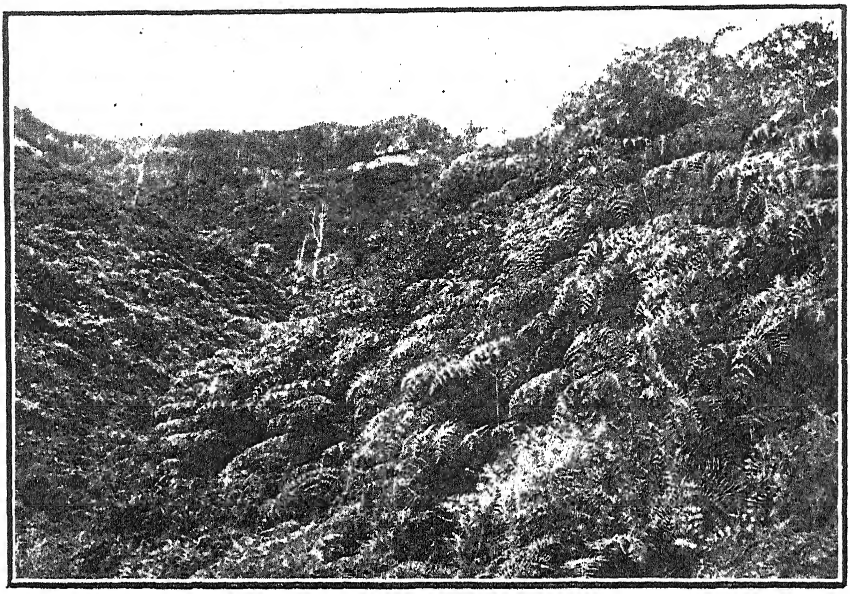


FIG. 12. THE BRACKEN-FERN PHASE IN THE SUCCESSION.

FIG. 13. BRACKEN-FERN ON A GOOD, DAMP SLOPE INVADED BY WINEBERRY.

Owing to the fact that wineberry can soon overtop bracken the latter is replaced.

[*Photos by E. B. Levy.*

the forest-burn three or four years after the forest-fire. It establishes in shade, under strewn branches or around logs, but it can and does also establish in the central portion of the water-fern and hard-fern patches (Fig. 11). By its strong underground rhizome its spread outward is fairly rapid, and so soon as no cattle run on the area the bracken-fern invasion is fairly fast. Sheep will scarcely eat bracken-fern at all, particularly when the frond is expanded, but cattle keep it well eaten down when forced on to it. Hard fern, and water-fern to a lesser extent, are non-shade endurers. Bracken-fern is a very much taller-growing plant than either of its fellows, and by its growth and spread it forms in the course of four or five years so dense a cover over the hard fern and water-fern that these become entirely killed out, leaving the bracken-fern in sole command of the situation (Fig. 12). The bracken-fern association may therefore be looked upon as another phase or step of the succession back to forest.

If the burn has been of a very intense nature, so that all forest-tree seeds have been killed out, this bracken-fern phase in the succession may last for hundreds of years. In the Taranaki back-country, however, burns are seldom so intensely hot that this happens. In this country, in the gullies and better soils, the next step in the succession begins after four or five or more years. Wineberry, lacebark, fuchsia, and tutu make their appearance—wineberry in particular (Fig. 13)—and now begins the replacement of the bracken-fern and the commencement of the secondary-forest cover, the processes and future development of which are almost identical with that which arises from the initial wineberry association already dealt with.

The bracken-fern phase does not necessarily follow on the hard-fern phase. It may take place in four or five years after the burn, particularly if very little stocking has been carried on. On the country too poor for wineberry and its associates bracken-fern may form the first step in the succession back to forest. Whether, however, the steeper fern-slopes have been derived from the initial burn or after the hard-fern phase their replacement in the Taranaki back-country by secondary forest is much the same. On this higher and drier fern country wineberry scarcely takes any part in the replacement. Tutu is perhaps the prime successional species, but bush-lawyer (*Rubus australis*) also comes in, and in the barer places appear koromiko (*Veronica salicifolia*), manuka, and karamu. The replacement is slow, and it may be twenty or thirty years or longer before there is much appearance of these shrubs among the bracken. In certain slightly richer soils the replacement is, however, more rapid, and once begun other trees come in. Lancewood, fivefinger, kohuhu, tarata, mahoe, kamahi, rangiora, putaputaweta (*Carpodetua serratus*), and hangehange are among the chief (Fig. 14). We thus get in forty or fifty years' time a secondary forest of a somewhat different type from that of the rather better and damper soils of the gullies and better slopes. This type develops into the primary forest by a replacement of certain of its members, and by the addition of certain other primary-forest trees which establish either in the course of the development of the secondary forest or in the shade of the association when well grown. Kamahi develops tremendously and may form an almost pure association, but, generally speaking, while the

FIG. 14. TUTU IN THE FINAL STAGE OF THE FIRST SECONDARY-FOREST PHASE.

On the floor of this association the following plants were well established : Mahoe, fivefinger, karamu, kanono, hangehange, miro, weki, *Blechnum discolor*, *Asplenium bulbiferum*, *Goniopteris pennigera.*

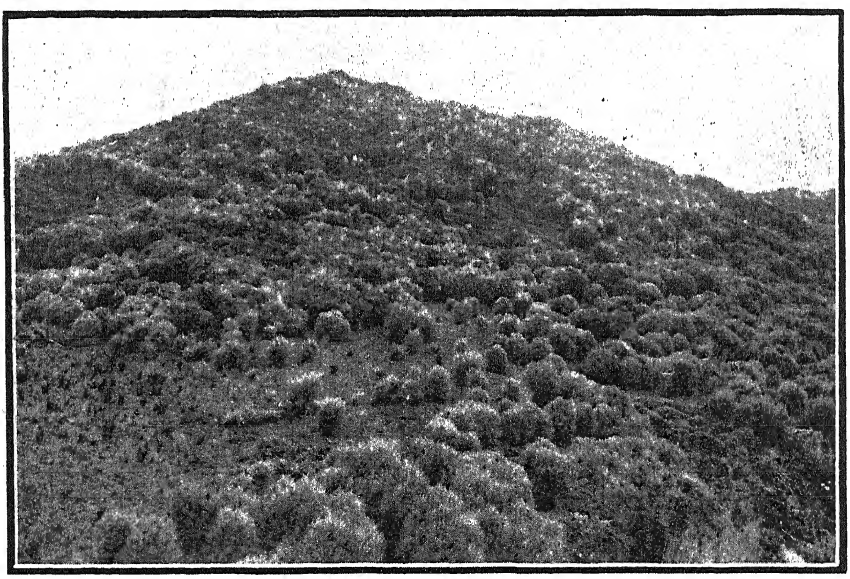


FIG. 15. THE MANUKA PHASE IN THE SUCCESSION, MANUKA RAPIDLY BECOMING DOMINANT.

[*Photos by E. B. Levy.*

FIG. 16. THE BEGINNING OF THE SECOND FOREST PHASE AFTER MANUKA-SCRUB.

The manuka has been cut down (note stumps), and kamahi (1) and mahoe (2) will be noted established on the scrub floor.

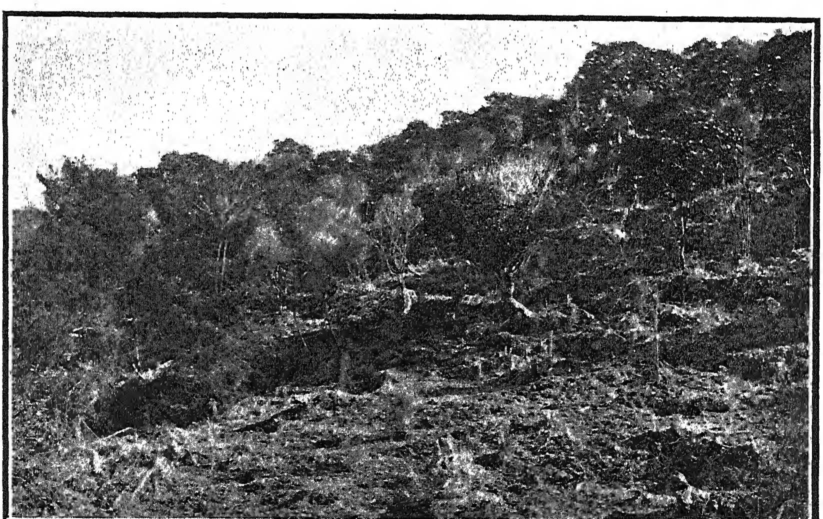


FIG. 17. SECONDARY FOREST, SIXTY YEARS OLD, AT TAHORA.

Showing in the photo are fivefinger, totara, kamahi, wineberry (dead and dying), and manuka.

Photos by E. B. Levy.

kamahi are quite small, hinau, rewarewa, totara, and possibly rimu establish themselves, and a mixed forest of these trees may exist for a long time. These forests by their growth during perhaps hundreds of years increase the humus content; hence the humidity of the forest-floor, and thus tawa is able to become established. In the meantime rata-vines will have established on the rimu (rata needs fairly open association forest to establish successfully), and by the time the tawa forest is mature the rimu forest is almost entirely replaced by rata. It is this forest state which exists mainly on the hill-slopes of the Taranaki back-country to-day.

SUCCESSION FOLLOWING ON CLOSE AND CONTINUOUS GRAZING.

There is yet another way by which nature attains her goal of a forest cover. Let us go back to within some ten years after the forest-burn that has partly run to hard fern and partly to bracken-fern, but which is yet sufficiently well stocked to control the bracken. Unless the pasture is well constituted and correctly managed the grasses sown will have become weakened, and the turf will have opened considerably. The constant grazing will have removed much fertility from the land, and unless this loss has been made good in one way or another the soil then really becomes too poor for the bracken-fern to spread very much. It is at this point that nature brings a very formidable agent to bear —manuka, the curse of the poorer hill country, comes in (Fig. 15). Once isolated plants become established the spread of manuka is remarkably rapid, and in six to eight years after its first appearance a dense manuka association may be formed. In the Taranaki back-country manuka is becoming very troublesome on the poorer and even better slopes which have become reduced in surface-fertility by injudicious stocking and poor pasture-management. Manuka is the plant nature uses regularly for afforestation processes on country too poor for bracken-fern, and so soon as the grass-sward begins to open up on the country in question manuka seems ready to invade that soil. The manuka association is therefore a phase in the succession back to forest on those soils that have been impoverished and which have failed to hold a sward of grass. The wineberry, the bracken-fern, and the manuka are really three equivalent stages in nature's afforestation processes. The manuka association remains very dense and bushy for some years, but as the development proceeds the canopy top is lifted higher—and once more subdued light penetrates to the scrub floor. Again we find the secondary forest establishing, but the process here is slower, for the conditions of soil are still too poor to allow of rapid growth. As soon as sufficient light enters, kamahi and mahoe establish. Rangiora also comes in soon after, and this latter species is often a very important one in the afforestation of manuka areas, but it may be quite thirty years before this stage is reached. In the Taranaki back-country kamahi and mahoe establish quite well among manuka on the better soils (Fig. 16), but where the greater depletion of soil-fertility has gone on these appear later. Pimelia (*Pimelia prostrata*), snowberry (*Gaultheria antipoda*), gaultheria (*Gaultheria rupestris*), mingi-mingi (*Leucopogon fasciculatus*), and club-moss (*Lycopodium volubile*) establish along with the stunted manuka, or on extremely depleted soils these may even precede the manuka. In such an association

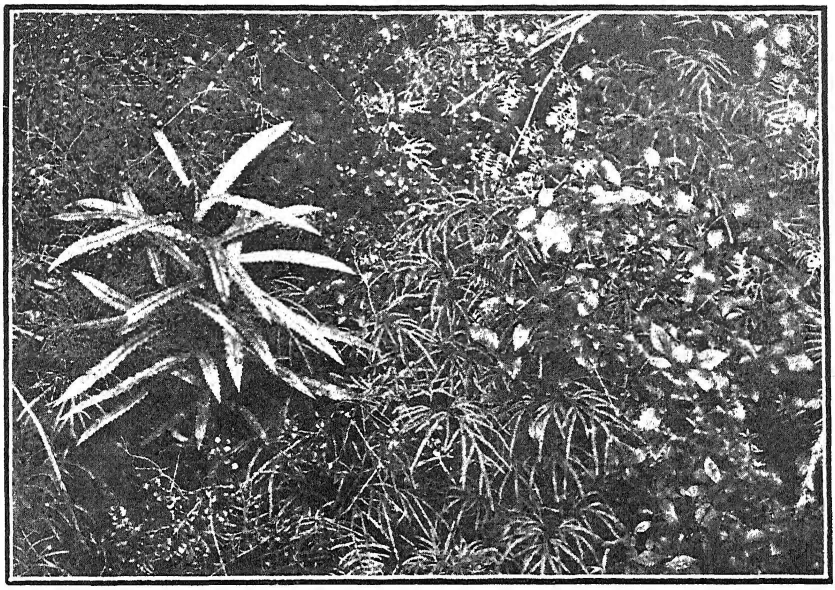


FIG. 18. ESTABLISHMENT OF FINAL PHASE OF SECONDARY FOREST IN THE ASSOCIATION SHOWN IN FIG. 17.

Rewarewa on left; kamahi on right; *Lycopodium volubile* covering the floor; and *Gaultheria antipoda* (behind rewarewa) also showing.

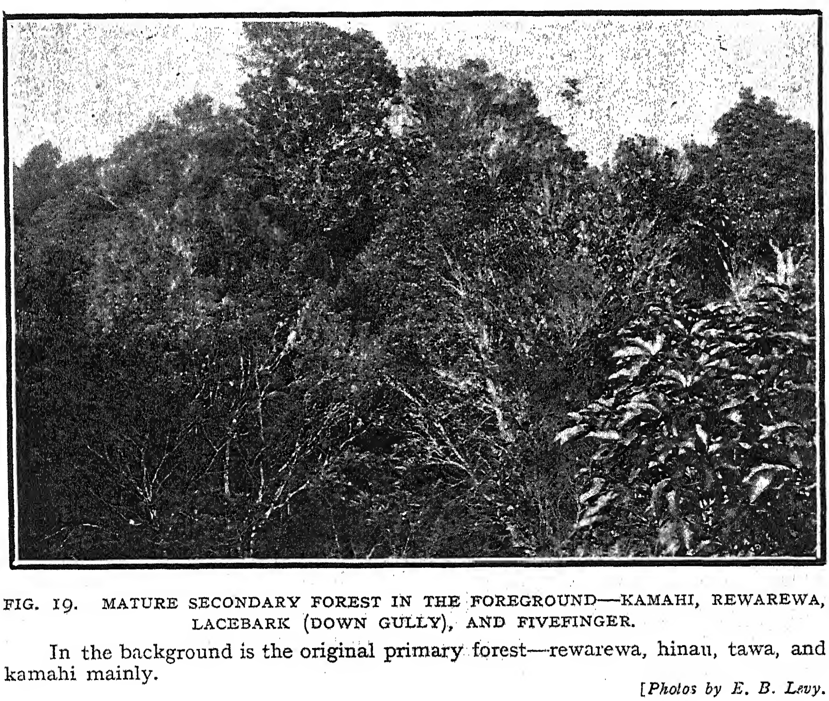


FIG. 19. MATURE SECONDARY FOREST IN THE FOREGROUND—KAMAHI, REWAREWA, LACEBARK (DOWN GULLY), AND FIVEFINGER.

In the background is the original primary forest—rewarewa, hinau, tawa, and kamahi mainly.

[*Photos by E. B. Levy.*

fivefinger may establish in abundance, and this is then followed closely by kamahi and totara. On the floor of such an association kamahi may readily re-establish, and here we find also the rewarewa quite at home.

Thus here we have perhaps one of the quaintest secondary forests to be found anywhere in New Zealand (Fig. 17). Fivefinger is the dominant tree, with odd totara and kamahi scattered here and there. In the better lower parts one or two wineberries may be seen, now old and decrepit. The lower story is filled with scrub—thin sapling manuka, scrubby kamahi, snowberry, and odd lancewood—in parts draped with dense masses of club-moss. Here perhaps club-moss is repeating its life-function of millions of years ago, preparing the way, now as then, for the great advance of the higher flowering-plants. As the conditions in this association improve, kamahi, rewarewa, and lancewood establish in greater numbers (Fig. 18), and this number is added to by totara, kohuhu, and tarata; and on the floor tupari may appear. This forest continues its development. The kamahi, rewarewa, fivefinger, tarata, kohuhu, lancewood, &c., grow into small forest-trees, and the underscrub of mingimingi, gaultheria, snowberry, and club-moss perishes. We then have once more the typical forest of the poorer slopes (Fig. 19), which ultimately will give way by degrees to tawa.

At Tahora, in a secondary forest such as this, may be seen the stately rimu setting out in truly graceful beauty to win back for that soil the primary forest that is in fact its heritage.

GENERAL.

From the foregoing it would appear that on the country in question secondary growth baffled the farmer at every turn; but secondary growth of a good character, vigorous and quick-growing, tells rather of possibilities of a country than of impossibilities. It tells of wealth in those soils if only this can be directed into channels useful to the farmer. A systematic study of this country is urgently needed, so that there may be sorted out and trials made of those pasture-species and methods of pasture-management which are seen to be giving the desired result.

(To be continued.)

A Twenty-one-year-old Ewe.—Mr. M. R. Findlay, Inspector of Stock, Kurow, Otago, sends the following note: "Longevity among our domestic animals is not often brought under notice, unless it is the age of some faithful horse which has served a shepherd or family for life, or perhaps a pony which has carried all the junior members of a household to school, while the ripe old age of some of our faithful canine friends is also at times commented upon. It is only on rare occasions that old age among sheep calls for particular attention. A ewe, the property of Mr. James Menzie, of Rosehill, Hakataramea, should just about be given pride of place in this respect, for, as the saying goes, she is 'old enough to vote.' This animal was born in January, 1902, from a Merino ewe by a Border Leicester ram, and was raised as a pet. She has reared seventeen lambs, but for the past three seasons has not been put to the ram, her owner wishing to see how ong he can keep her alive. Unlike most pet sheep, she was never a fencer, a fact which no doubt saved her from the butcher's hook years ago."

STUD-STOCK BREEDING.

ADVICE REGARDING SHEEP.

Paper communicated to the New Zealand Board of Agriculture by Mr. W. PERRY, "Penrose," Masterton.

IT is with a feeling of diffidence that I consent to give an opinion on breeding of stud animals. The experience I have had has been wholly with long-woolled sheep, and I am of opinion that methods that will work out quite well when breeding Merino sheep, on account of their purity and evenness of type, will not be satisfactory with long-woolled sheep.

Having been in charge of a Lincoln flock for forty years, a Romney flock for sixteen years, and an English Leicester flock for ten or twelve years, it has given me a very good opportunity of following different methods of breeding and watching results, and has practically brought me to the conclusion that none of the systems, such as in-and-in breeding, line-breeding within the same line of blood, line-breeding with unrelated families, or consistent outcrossing, can be followed exclusively when breeding long-woolled sheep. Undoubtedly close breeding or keeping within the same blood is the only way to produce great and valuable sires, but there are limitations beyond which the breeder must not go. Great judgment is required in this matter to know when the danger-line has been reached. The loss of vitality comes on gradually and is not easily detected; the wool-covering is affected as well.

There is a lot of literature on breeding, and most of the writers quote the pedigrees of champion animals as being closely inbred; but nothing is known of the percentages of failures the breeders of those animals had in their matings. There is no straight road to success. With all the advantages possible, it is not so difficult to reach a high standard with a flock as to maintain it.

There are several recognized methods of breeding—namely, (1) In-and-in breeding; (2) line-breeding with distant strains of the same blood; (3) line-breeding with distinct families; (4) outcrossing, which means continuous change of blood.

The method of outcrossing is very misleading to the young breeder. If he is careful to select sires similar in appearance to his flock he will apparently produce some useful-looking animals at first, but the more fresh blood he introduces the more uneven will be the result. I had this experience when I first started with Lincoln sheep, and did not do any good until the method of line-breeding was adopted. Rams bred on the outcross principle are no good to the stud breeder, and very little better for the ordinary flockmaster. Sheep bred in this way are much like the crossbred: they mature quicker than the line-bred sheep, and at two-tooth they look very promising, but do not last; and the result of mating them with crossbred ewes will be anything but satisfactory. Any one who has read and studied Mendel's

laws of heredity will quite easily understand why the outcrossing methods cannot lead to any great success.

There is no question that many breeds have been made by the method of in-and-in breeding, which means the mating of nearly related animals; but once a breed is established there does not seem so much need to practise it to any great extent. It is decidedly useful, if one procures an outstanding sire, to mate a few nearly related ewes of the same family and type, the progeny of which, if successful, would be very valuable; but to continue would, I think, only be courting trouble. Before attempting to inbreed it is necessary to have an intimate knowledge of the history of the animals to be mated. I have tried mating in this way with varying success; in one particular instance the result was a decided success.

Line-breeding with distant strains of the same blood is the ideal system. By selection leading faults can be eliminated, family lines can be established, and a flock, if large enough, can be carried on a number of years on these lines improving all the time. But there comes a time when, if some fresh blood is not introduced, the young sheep will be slower to mature and harder to get into condition, and will show less covering on their points and a general falling-away in vigour. I had this happen with my Lincoln flock, and if a flock is allowed to go too far it takes quite a time to bring it back to normal. To avoid this happening, a safe method is to purchase a few outstrain ewes, use the home ram on them, and if the results are satisfactory use the half-blood through the flock. It may be that selection has something to do with slow maturity after a flock becomes closely bred for some years. A good sire in either the Lincoln or Romney breeds must have a lasting fleece—*i.e.*, it should grow good wool until four or five years old. A sheep which will carry sound wool until that age is invariably a very firm-fleshed animal and free from excessive fat. These animals are a little slower in coming to maturity, and the more you inbreed them the more you intensify the slow-maturing qualities.

Line-breeding with distinct strains of blood is no doubt a safe method for the beginner, but the great difficulty is to get a number of separate strains of blood of equally good quality and alike in type to start with. It would take years to bring a flock bred in this way to anything like evenness.

To be successful at stud breeding a person must have a natural gift for observing the good and bad points and the general characteristics of each animal; by so doing he will know all his best animals by sight, which is of great assistance when dealing with the flock.

The safest method the young breeder can adopt is to make up his mind on the type of sheep he would like to breed, select his stock from the breeder whose sheep come nearest to this ideal, and continue doing so as long as the parent flock continues to be up to standard. As time goes on, if he is a keen observer of his animals, he will be able to analyse them at a glance. When this stage is reached, success should crown his efforts. Suitable climate and soil for the particular breed are essential; good judgment in selecting and mating, and good judicious feeding are all necessary before success can be obtained.

STINKING-SMUT OF WHEAT.

I. THE EFFECT ON GERMINATION OF SOME SEED-DISINFECTANTS.

J. C. NEILL, Wellington.

THE disease of wheat known as stinking-smut, sometimes called covered smut or bunt, is due to one or both of two closely allied fungous parasites, *Tilletia Tritici* (Bjerk.) Wint. and *Tilletia levis* Kuehn. From the earliest historical times, and in all countries, it has caused greater aggregate loss to the grower than any other wheat-disease, and in New Zealand it is still the most formidable enemy of the wheat crop. Where no preventive measures are taken stinking-smut may take anything from 5 per cent. to 40 per cent. of the crop ; and, further, even a small percentage of smutted heads lowers greatly the market value of the wheat, rendering it unfit for milling, while badly smutted lines are unsuited even for use as fowl-feed.

Fortunately, since the discovery of the hot-water, bluestone, and formalin treatments of the seed-wheat it has been possible, under such conditions as prevail in the New Zealand wheat-growing areas, to reduce the amount of stinking-smut normally present to very small proportions.

In New Zealand the main, and possibly the sole, cause of infection is by means of spores of the fungus which become attached to the seed during harvesting and threshing. When the seed is sown the fungus-spores germinate at about the same time as the wheat-seed, and, sending out germ-tubes, which penetrate the tender seedlings, become established in the tissues of the growing plant. As the wheat-plant grows, the fungus grows with it, showing no outward sign of its presence until flowering-time, when it establishes itself in the young wheat-grains. Here the fungus grows rapidly at the expense of the food material stored in the grain, finally converting the whole contents of the seed-envelope into a black mass composed of millions of the fungus-spores. The name stinking-smut is derived from the peculiar rancid smell given off by these "smut balls," which imparts a distinctive mustiness to flour milled from wheat in which they are present in any quantity. As the outside coat of the grain is still intact it is only by fairly close observation of the wheat-ear that the presence of the smut can be detected. When the crop is harvested and threshed the smut balls are more or less broken, distributing over the clean wheat their millions of contained spores, which adhere so tenaciously that no mechanical cleaning process will remove them.

In countries where a summer fallow system is practised, notably in north-western America, infection of the soil by wind-borne spores liberated from the threshers becomes, in some years, a factor of great importance in the spread of smut. If the autumn wheat is sown in

such infected soil while dry, then, after the first rain, both wheat-seed and smut-spore germinate together—an ideal condition for the parasite. Previous treatment of the seed would in this case be largely ineffective in preventing infection, the most hopeful method lying in the breeding of immune varieties of wheat. Fortunately, only very exceptionally are such conditions likely to occur in New Zealand.

Under present conditions, therefore, the problem of stinking-smut control in this country consists in finding some means whereby the smut-spores carried by the wheat-seed may be destroyed without injury to the wheat itself, and which will be cheap and easy to apply under farm conditions. A review of the published accounts of experiments to this end conducted in other countries shows that the best results in the past have been obtained by various modifications of the hot-water, bluestone, and formalin dips. Hot-water treatments, though effective if properly applied, are not adapted to farm practice, and so are not included in the present inquiry.

Practically all observers agree that both the formalin- and bluestone-dip treatments, if properly carried out, will completely prevent infection by seed-borne spores, but there is equal agreement that both injuriously affect the germination of the wheat. Injury to the seed-coat of the grain in threshing seems to be the predisposing cause of this harmful action of the fungicide, as the germination of hand-threshed seed does not appear to be materially affected.

Microscopical examination of samples of two of the wheats, presumably machine-threshed, used in the experiments here recorded showed injuries as follows: Pearl—Uninjured, 65 per cent.; seed-coat broken, over endosperm, 7 per cent., over embryo, 26 per cent.; embryo broken off, 2 per cent. Tuscan—Uninjured, 80 per cent.; seed-coat broken, over endosperm, 3 per cent., over embryo, 15 per cent.; embryo broken off, 2 per cent.

Hand-threshed seed is not a commercial possibility in New Zealand, but every effort should be made in machine threshing to minimize injury, and samples of seed-wheat that show much broken seed-coat when viewed under a hand-lens should be rejected.

Various modifications of the standard bluestone- and formalin-dip treatments have been recommended, the most promising of which are being tested in these experiments. Unfortunately, it has not been possible to test in the laboratory the current farm practice of sprinkling and turning on a floor as compared with the complete dip, but it is hoped to do this later under practical farm conditions.

The question as to whether delay in sowing seed which has been treated will injuriously affect germination is one of great importance, especially in a wet winter such as experienced this year. Formalin in particular has a bad reputation in this respect, but an elaborate inquiry in the United States by Hurd shows that post-treatment injury only takes place at humidities below 70°, a degree of dryness rarely attained by New Zealand air in winter. Further, it is stated that damage by formalin can be entirely avoided by washing in water after treatment. Part of the present series of experiments is designed to verify these statements, though a complete test can be made only under field conditions.

In recent years two other promising methods for the disinfection of seed have been discovered—a dry treatment with copper-carbonate dust, introduced by Darnell-Smith in New South Wales in 1917, and a wet process using certain organic mercury compounds (uspulun, germisan, chlorophol, &c.), which has given good results in Germany, and which it is hoped to test here when supplies of the compounds become available. The copper-carbonate dry-dusting treatment of Darnell-Smith offers many practical advantages over any of the wet methods, and it is claimed for it that germination is rather increased and strengthened even after prolonged post-treatment storage. While showing good results in the recorded experiments on smut-control, there appears to be some doubt as to whether it is as effective as the formalin or bluestone. This can only be settled for local conditions by careful field experiments in the wheat-growing areas of New Zealand.

The present high cost of copper carbonate—about 6s. per pound—is a distinct disadvantage, though it is expected that if the demand increases the cost of production will be considerably reduced. Used at the standard rate of 2 oz. per bushel of seed the cost of treatment will be 9d. per bushel, as against 3d. per bushel by the present methods. Still, if by using copper carbonate the rate of sowing can be reduced from $1\frac{1}{2}$ to $1\frac{1}{4}$ bushels per acre—representing 1s. 6d. at 6s. per bushel—at an increased cost of $6\frac{3}{4}$d., then there is a net gain of $11\frac{1}{4}$d. per acre in addition to the convenience and ease of handling.

Another dry treatment, using a mixture of anhydrous copper sulphate and limestone, has given fairly good results in the United States, and it has the advantage of being considerably cheaper in cost of material.

The usual farm practice in New Zealand is to treat the seed-wheat with either bluestone or formalin, which, although giving fairly satisfactory results in the control of smut, is considered to reduce germination to such an extent that an additional 10 to 20 per cent. of seed must be sown to ensure the requisite stand.

Taking the total seed-wheat used in New Zealand at 400,000 bushels, the annual loss due to this excess sowing is from 40,000 to 80,000 bushels. At 6s. per bushel this represents a cost to the growers of from £12,000 to £24,000 per annum. The primary object of the present investigation is to find how this wastage may be reduced or perhaps eliminated.

I wish to acknowledge the assistance received from the Officer in Charge and the staff of the Biological Laboratory, Wellington, wherein the preliminary work recorded here has been performed—especially to Mr. N. R. Foy, Seed-analyst, and his assistants, who carried out all the germination tests here recorded; to the Mycologist, Mr. G. H. Cunningham, for laboratory facilities and constant advice. Mr. F. E. Ward, Instructor in Agriculture, Christchurch, also supplied much helpful information.

PRELIMINARY LABORATORY EXPERIMENTS.

These experiments were planned to give reliable data on one factor only of the stinking-smut problem—that of the actual effect on wheat-seed, germinated under ideal conditions, of the more promising standard

methods of disinfection. The corresponding effects under field conditions, and the relative efficiency in control of the smut, will be taken up in future work in the field.

Methods.

Samples of seed were obtained from the Instructor in Agriculture, Christchurch, and three were selected (to represent the three classes of wheat chiefly grown in New Zealand)—namely, Pearl, College Hunters, and Purple-straw Tuscan. From each of these, twenty-four lots of 100 seeds (fair average sample) were counted out, placed in corked test-tubes, and treated in duplicate as follows :—

(1.) Dry-dusting with copper carbonate. Weights of dry, finely powdered copper carbonate, equivalent to weights of ½ oz., 1 oz., 2 oz., and 3 oz. per bushel, were vigorously shaken with different samples of the seed.

(2.) Dry-dusting with a mixture of 50 per cent. finely powdered anhydrous copper sulphate and 50 per cent. finely powdered calcium carbonate. Weights of the mixture, equivalent to weights of 1 oz., 2 oz., 3 oz., and 4 oz., were shaken with the seed as in No. 1.

(3.) Bluestone dip : 1 lb. bluestone (copper sulphate) in 10 gallons water.

(4.) Bluestone dip : 1 lb. bluestone in 5 gallons water.

(5.) Formalin dip : 1 pint commercial formalin in 40 gallons water. Each of the dip treatments (Nos. 3, 4, and 5) were tested in four different ways as follows :—

A. Sample covered with the dip solution for ten minutes, then surplus solution poured off and sample left in wet mass for twenty minutes, then spread out on blotting-paper in room to dry overnight.

Aw. Sample treated as in A, but rinsed in clean water immediately before being spread out to dry.

B. Presoak method : Sample first covered with clean water for ten minutes, then surplus water poured off and seed left in wet mass for six hours, then treated as in A.

Bw. Presoak method plus wash : Sample presoaked as in B, then treated as in Aw.

Three series of each wheat were thus treated. One lot was placed in the germinators on the day following treatment ; the other two lots were stored in corked test-tubes till tested, one at fourteen days and the last lot at twenty-eight days after treatment. With duplicates and untreated controls a total of 378 samples of 100 seeds each were tested for germination. The results are set out in the accompanying tables.

The following references apply to the bluestone and the formalin treatments in each of the three tables :—

A treatment—Cover with solution 10 minutes, drain 20 minutes, then spread out to dry.

Aw—Same as A, but treated seed washed in water before drying.

B—Soaked in water 10 minutes, drained 6 hours, then treated as in A.

Bw—Same as B, but washed in water after treatment and before drying.

Table I. Seed placed in Germinators One Day after Treatment.

Treatment.	Germination Percentage.															
	Pearl.				Hunters.				Tuscan.				Average of the Three Varieties.			
Counts at	3 days	6 days	10 days	14 days	3 days	6 days	10 days	14 days	3 days	6 days	10 days	14 days	3 days	6 days	10 days	14 days
Copper Carbonate.																
½ oz. per bushel ..	95	95	95	95	82	91	91	91	89	96	96	96	88	94	94	94
	96	97	97	97	78	90	90	91	89	95	95	95				
1 oz. per bushel ..	97	97	97	97	77	98	98	98	83	96	96	96	82	96	96	96
	95	95	95	95	67	94	94	94	73	94	95	95				
2 oz. per bushel ..	93	96	96	96	70	95	95	95	87	96	98	98	84	96	96	96
	97	98	98	98	77	96	97	97	84	93	95	96				
3 oz. per bushel ..	94	95	96	96	88	90	90	91	80	94	95	95	84	94	94	94
	92	94	94	94	77	95	95	95	76	93	93	94				
50-per-cent. Mixture of Copper Sulphate (anhydrous) and Calcium Carbonate.																
1 oz. per bushel ..	95	95	95	95	86	90	90	91	87	96	96	96	90	94	94	95
	97	97	97	97	92	97	97	97	84	93	95	96				
2 oz. per bushel ..	95	96	96	96	94	95	95	95	88	95	95	96	91	94	94	95
	95	95	95	95	89	92	92	92	85	95	96	96				
3 oz. per bushel ..	99	99	99	99	89	92	93	93	89	96	96	96	91	95	95	95
	100	100	100	100	89	91	92	92	83	94	94	94				
4 oz. per bushel ..	95	95	95	95	94	99	99	99	91	96	98	98	91	96	96	96
	91	93	93	93	88	97	97	97	90	95	96	96				
Bluestone (1 lb. in 10 gallons water).																
A	42	77	90	90	40	93	94	95	36	69	84	86	35	78	89	91
	37	76	96	96	27	79	82	86	30	68	89	91				
Aw..	72	97	97	97	..	..	..	..	54	77	84	84	53	82	92	92
	61	95	96	97	..	..	..	..	39	88	92	92				
B	41	79	91	92	43	76	83	87	47	79	91	94	39	79	88	89
	35	80	88	89	37	78	86	87	33	80	87	89				
Bw..	52	82	85	88	..	..	..	..	52	82	90	93	51	82	88	91
	56	83	89	91	..	..	..	..	47	82	88	91				
Bluestone (1 lb. in 5 gallons water).																
A	39	71	92	96	12	74	88	91	39	64	80	83	32	69	87	90
	39	65	88	92	20	77	85	88	44	67	90	92				
Aw..	44	88	96	97	14	72	86	87	50	84	93	93	33	79	91	92
	37	76	92	92	22	79	90	90	31	80	92	93				
B	21	61	79	84	25	63	82	85	33	75	91	93	26	62	84	84
	16	52	73	77	25	56	72	79	38	67	85	86				
Bw..	50	78	92	93	54	75	86	90	51	84	91	91	49	86	89	91
	54	86	91	95	40	70	82	87	49	87	94	94				
Formalin (1 pint in 40 gallons water)																
A	97	99	99	99	61	94	94	94	66	94	94	95	76	94	94	95
	93	95	95	95	67	90	91	91	70	94	94	94				
Aw..	90	92	92	92	84	93	93	93	83	99	99	99	86	96	96	96
	98	98	98	98	84	94	94	94	88	99	99	99				
B	88	90	91	91	88	97	97	97	85	93	93	93	86	92	93	93
	95	95	95	95	75	83	85	85	90	98	98	98				
Bw..	93	94	94	94	70	90	90	90	92	95	95	95	87	94	94	94
	98	98	98	98	72	91	91	92	96	97	97	97				
Untreated.																
Controls	95	96	96	96	..	..	..	..	81	98	98	98	88	97	97	97
	95	96	96	97	55	94	94	95	89	96	96	96				
	95	97	97	98	49	94	94	94	94	98	98	98				
	94	100	100	100	..	..	..	..	98	99	99	99				

Table II. Seed placed in Germinators Fourteen Days after Treatment.

Treatment.	Germination Percentage.															
	Pearl.				Hunters.				Tuscan.				Average of the Three Varieties.			
Counts at	3 days	6 days	10 days	14 days	3 days	6 days	10 days	14 days	3 days	6 days	10 days	14 days	3 days	6 days	10 days	14 days
Copper Carbonate.																
½ oz. per bushel ..	95	95	..	95	80	93	93	93	94	96	96	96	92	95	95	96
	96	96	..	96	92	97	97	97	95	96	96	97				
1 oz. per bushel ..	94	95	..	95	83	91	92	92	93	96	96	96	90	94	95	95
	89	94	..	94	84	95	95	95	97	97	97	98				
2 oz. per bushel ..	93	94	..	94	80	93	95	96	93	94	94	94	91	95	95	95
	95	96	..	96	93	97	97	97	91	95	95	95				
3 oz. per bushel ..	94	94	..	94	83	94	94	95	86	92	93	93	91	94	94	95
	92	96	..	96	81	98	98	98	92	94	95	95				
50-per-cent. Mixture of Copper Sulphate (anhydrous) and Calcium Carbonate.																
1 oz. per bushel ..	94	96	..	96	89	92	92	92	97	97	97	97	92	94	94	94
	98	98	..	98	86	89	89	90	87	90	90	90				
2 oz. per bushel ..	97	98	..	98	86	90	90	90	94	96	96	96	91	96	96	96
	92	96	..	96	80	97	97	97	97	100	100	100				
3 oz. per bushel ..	94	96	..	97	83	95	95	95	90	93	93	94	90	94	94	95
	97	98	..	98	80	92	92	92	96	96	96	96				
4 oz. per bushel ..	97	97	..	97	89	94	94	94	95	95	95	97	93	95	95	95
	97	97	..	97	84	93	93	93	95	96	96	96				
Bluestone (1 lb. in 10 gallons water).																
A	56	81	..	94	61	82	91	94	65	76	83	85	57	78	88	91
	35	73	..	89	62	82	88	92	61	76	85	90				
Aw..	54	91	..	96	..	..	..	..	58	78	86	90	62	84	84	93
	78	96	..	97	..	..	..	..	59	73	83	90				
B	54	80	..	90	63	77	86	90	61	76	86	89	51	77	85	89
	41	74	..	89	52	86	90	92	57	70	80	84				
Bw..	63	89	..	94	..	..	..	..	69	85	88	90	70	88	92	93
	65	88	..	93	..	..	..	..	85	93	96	97				
Bluestone (1 lb. in 5 gallons water).																
A	32	54	..	81	35	64	80	84	40	54	70	77	35	56	69	82
	30	50	..	88	38	66	81	84	38	49	66	80				
Aw..	39	82	..	92	47	72	87	92	41	57	79	86	45	71	82	90
	49	80	..	95	52	75	84	88	42	59	77	88				
B	18	52	..	78	46	73	85	89	25	44	71	76	32	55	77	78
	9	26	..	61	44	72	78	85	49	64	74	81				
Bw..	27	71	..	88	46	74	82	84	63	69	81	85	42	71	81	86
	23	70	..	90	39	75	81	85	55	67	81	84				
Formalin (1 pint in 40 gallons water).																
A	93	96	..	96	33	95	95	95	67	80	84	85	65	88	89	92
	96	96	..	96	30	83	90	90	70	81	87	90				
Aw..	95	95	..	95	82	91	92	92	85	87	87	87	87	91	91	93
	98	98	..	98	79	90	92	92	86	90	93	93				
B	89	96	..	96	91	93	93	93	89	92	98	98	91	94	95	96
	90	94	..	95	95	96	96	96	94	95	96	97				
Bw..	93	94	..	95	97	99	99	99	96	97	97	97	94	96	96	96
	95	97	..	97	91	95	95	95	92	93	95	95				
Untreated.																
Controls	96	99	..	99	94	95	95	95	95	96	96	96	93	95	95	95
	94	96	..	96	86	92	92	92	90	92	92	92				
	96	97	..	97	..	..	..	..	96	98	99	99				

Table III. Seed placed in Germinators Twenty-eight Days after Treatment.

Treatment.	Germination Percentage.															
	Pearl.				Hunters.				Tuscan.				Average of the Three Varieties.			
Counts at	3 days	6 days	10 days	14 days	3 days	6 days	10 days	14 days	3 days	6 days	10 days	14 days	3 days	6 days	10 days	14 days
Copper Carbonate.																
½ oz. per bushel ..	96	96	97	97	91	99	99	99	77	97	97	97	88	96	97	97
	97	99	99	99	89	95	95	95	77	94	95	95				
1 oz. per bushel ..	95	98	98	98	89	92	92	92	62	98	98	98	83	95	95	95
	93	94	94	94	79	94	94	94	80	95	95	96				
2 oz. per bushel ..	91	99	99	99	84	98	98	98	70	97	97	98	81	95	96	96
	86	92	93	93	89	94	94	94	68	92	93	94				
3 oz. per bushel ..	90	94	94	94	88	94	95	95	64	95	95	95	81	94	95	95
	92	95	95	95	85	94	94	94	66	95	97	97				
Anhydrous Copper Sulphate and Calcium Carbonate.																
1 oz. per bushel ..	95	95	95	95	92	98	99	99	79	99	100	100	93	96	97	97
	93	96	96	96	87	94	94	94	90	96	97	97				
2 oz. per bushel ..	94	95	95	95	91	97	97	97	80	96	96	96	88	95	95	95
	94	97	97	97	88	90	90	91	79	94	94	94				
3 oz. per bushel ..	94	98	98	98	90	97	98	98	81	96	96	96	89	96	96	96
	96	98	98	98	90	95	95	95	81	95	95	95				
4 oz. per bushel ..	95	99	99	99	91	94	94	94	80	96	96	96	87	96	96	96
	96	97	97	97	90	93	94	94	71	95	96	96				
Bluestone (1 lb. in 10 gallons water).																
A	21	62	85	86	33	83	87	88	11	66	85	91	29	72	86	89
	30	70	89	93	50	77	82	84	10	76	91	95				
Aw..	42	89	92	93	..	..	..	..	13	76	88	89	26	82	91	92
	30	82	93	94	..	..	..	..	20	81	91	93				
B	8	43	71	76	40	80	84	85	10	71	86	88	20	63	81	83
	14	52	80	91	43	76	83	84	9	60	83	85				
Bw..	21	82	94	94	..	..	..	..	14	63	76	77	18	68	84	84
	25	65	87	87	..	..	..	..	12	64	79	80				
Bluestone (1 lb. in 5 gallons water).																
A	25	50	83	86	31	59	72	78	8	49	73	78	22	52	74	79
	32	52	78	84	27	60	73	77	10	44	66	75				
Aw..	25	81	92	92	34	75	87	88	25	77	91	95	28	72	87	88
	30	80	96	96	45	67	83	84	12	54	73	76				
B	7	28	64	69	18	55	65	68	7	55	72	80	12	47	68	74
	11	41	71	80	21	51	61	68	12	56	75	81				
Bw..	15	53	74	78	36	61	77	78	21	66	81	86	33	60	78	81
	11	59	83	86	32	64	72	72	19	60	81	83				
Formalin (1 pint in 40 gallons water).																
A	93	97	97	97	21	85	88	89	4	88	91	91	39	90	92	93
	92	98	98	98	20	82	88	89	4	89	91	92				
Aw..	96	96	96	96	71	91	92	92	26	88	90	90	65	90	92	92
	95	96	96	96	67	83	85	86	35	88	91	91				
B	91	96	96	96	86	94	94	94	67	92	93	93	84	93	93	93
	95	95	95	95	93	95	95	95	70	90	90	90				
Bw..	93	94	94	94	86	90	90	90	87	95	96	96	86	92	93	93
	92	93	95	95	85	94	94	94	78	87	88	88				
Untreated.																
Controls	86	94	94	94	70	99	99	99	91	97	97	97	84	97	97	97
	91	97	97	97	86	97	97	97	88	97	97	97				
	88	97	97	97	..	..	..	..	85	95	95	95				
	..	..	..	..	..	..	..	..	84	95	95	95				

SUMMARY OF EXPERIMENTAL RESULTS.

(1.) *Dry-dusting Treatments.*—Neither the copper-carbonate nor the anhydrous-copper-sulphate and calcium-carbonate mixture caused any appreciable damage to the wheat-seed in vitality or germinating-power.

(2.) *Bluestone-dip Treatments.*—The bluestone dip in all cases injured the germinating-power and vitality of the wheat-seed. This injury increased with the increased strength of the dip, and also with the length of time that the seed was held in storage after treatment. Washing in water after dipping materially reduced this injury. The presoak methods increased the injury caused by bluestone. Deterioration on post-treatment storage was more pronounced with the varieties Pearl and Tuscan than with Hunters.

(3.) *Formalin-dip Treatments.*—The effect of the formalin dip varied considerably with the different wheat varieties. Pearl appeared to be uninjured by the dip even after twenty-eight days' post-treatment storage. This result is very surprising when considered in relation to the large amount of broken seed-coat in the sample, as specified earlier in this article. Hunters showed a certain retardation of germination the day after treatment by all the formalin-dip methods. After post-treatment storage for fourteen days the vitality of the seed was distinctly impaired. This was reduced by washing the seed in water after dipping, and was entirely eliminated by the preliminary presoak method. The twenty-eight-days post-treatment storage results showed a decrease in vitality all round—reduced to small proportions by presoaking. Tuscan gave results very similar to Hunters, with slightly greater advantage by presoaking.

GENERAL.

The experimental laboratory results here recorded, while in part agreeing with the published records of work in other countries, cannot be accepted as a reliable practical guide until confirmed and extended by field trials in New Zealand.

The methods which show least damage to the seed may not be efficient in controlling the smut, and a method showing good laboratory results may be impracticable on the farm. Further, the relative cost of each method must be balanced against its efficiency.

The most instructive feature of the tabulated results lies not in the total germination, but in the proportion of seed which had germinated at the third-day and sixth-day counts respectively. It is probable that in the field very few of the seedlings whose germination is included in the subsequent counts would ever develop to grain-producing plants.

Quick and strong germination of the seed is a vital factor not only in the subsequent vigour and productivity of the crop, but also in immunity from attack by stinking-smut and other parasitic fungi.

LITERATURE CONSULTED.

BRAUN, H.: Presoak Method of Seed Treatment. *Journal of Agric. Research*, vol. 19, pp. 363–391, 1921. Effect of Delayed Planting of Seed Wheat treated with Formalin. *Phytopathology*, vol. 12, pp. 173–179, 1922.

DARNELL-SMITH, G. P.: The Prevention of Bunt. *Agric. Gaz. N.S.W.*, vol. 28, pp. 185–189, 1917. A Dry Method of Treating Seed Wheat for Bunt. *Ibid.*, vol. 32, pp. 796–798, 1921.

HEALD, F. D., ZUNDEL, G. L., and BOYLE, L.W.: The Dusting of Wheat and Oats for Smut. *Phyto.*, vol. 13, pp. 169–183, 1923.

HUNGERFORD, CHAS. W.: The Relation of Soil-moisture and Soil-temperature to Bunt Infection in Wheat. *Ibid.*, vol. 12, pp. 337–351, 1922.

HURD, ANNIE MAY: Injury to Seed Wheat resulting from Drying after Disinfection with Formaldehyde. *Jour. Agric. Res.*, vol. 20, pp. 209–224, 1920. Seed-coat Injury and Viability of Seeds of Wheat and Barley as Factors of Susceptibility of Moulds and Fungicides. *Ibid.*, vol. 21, pp. 99–121, 1921.

STEPHENS, D. E., and WOOLMAN, H. M.: The Wheat-bunt Problem in Oregon. *Oregon Agric. Exp. Sta. Bull.* 188, 42 pp., 1922.

TISDALE, W. H., TAYLOR, J. W., and GRIFFITHS, MARION A.: Experiments with Hot Water, Formaldehyde, Copper Carbonate, and Chlorophol for the Control of Barley-smuts. *Phyto.*, vol. 13, pp. 153–160, 1923.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

III. BAKING-TESTS OF FLOURS.

L. D. FOSTER, Analyst, Chemistry Section, Wellington.

PRACTICAL tests being always the more convincing, it was considered advisable, in continuation of the testing of New-Zealand-grown wheats, to corroborate by actual baking-tests information obtained from the chemical examination of flours, and to illustrate if possible the truth of the statement that the protein content of a wheat (or flour) is generally a fair measure of its strength. Baking-tests of the flours from wheats which were experimentally milled have now been successfully carried out in this Laboratory. For the results of the chemical analyses the reader is referred to Table II in this series, in the August issue of the *Journal*.

Bread, according to T. B. Wood, is the product of cooking or baking a mixture of flour, water, and salt, which is made porous by the addition of yeast. Several varieties of the process of breadmaking are practised, but for the purposes of these tests the "straight-dough" process was used, and for the following reasons: It required less time, it was easier to control the temperature-changes over a comparatively short period than over the longer periods of the other methods, and the results were likely to be more accurate.

It is at once apparent that in making tests on different samples it is imperative that they should be so conducted that the differences in results are due to the inherent qualities of the flours themselves, and not to modifications of the method used. It is therefore of importance that the conditions under which the tests are carried out should be strictly the same in every case. These conditions are maintained chiefly by careful regulation of the temperatures from the time the dough is first mixed to the time the bread is finally removed from the oven.

METHODS OF BAKING (STRAIGHT-DOUGH PROCESS).

In order to maintain the necessary temperature conditions the different ingredients were warmed to 35° C. before being incorporated in the dough; this was thoroughly mixed and kneaded, weighed, and allowed to ferment for a specified length of time in a fermentation-chamber kept also exactly at 35° C. Here the dough was allowed to rise to a maximum height, when the amount of rise and the time taken were noted, and the dough again weighed. It was then immediately put into the oven, which was kept at 220° C.; the loaf was baked at that temperature for thirty-five minutes. With each series of loaves—only six of which could be baked at a time—a commercial "baker's" flour was included for purposes of comparison and for standardization of the various series.* On being taken from the oven each loaf was removed at once from its tin, weighed, and cooled as quickly as possible. After standing for one hour the volume of each loaf was measured.

To produce bread of good quality from the point of view of size, uniformity of texture, &c., the dough (in other words, the gluten) must be elastic—that is, it must expand or "rise." The volume of a loaf is a measure of this elasticity, and, it follows, of its quality. Having baked the loaf and measured its volume, other things (colour, &c.) being equal, a practical measure of quality or strength is obtained.

In each case exactly the same amounts of each ingredient were used for the tests, and each dough received exactly the same treatment, except that (*a*) the amount of water added was suited to the requirements of the flour as shown by the absorption-of-water figure, and (*b*) the fermentation period was varied to allow a maximum expansion to be reached in each case; in the case of weaker flours this period was generally longer than with stronger samples.

BAKING-TESTS.

It will be remembered that in the second article of this series it was said that the amount of protein present was probably the best single measure of the strength of a flour. A series of loaves containing high to low amounts of protein, and illustrating this statement, is shown in Fig. 1. It is at once apparent that here No. 2 is easily the best as regards volume, and that the value of the others is in descending order of protein content. No. 1 is from the commercial flour baked with each series. The largest loaf is from a sample of Velvet grown at Middlemarch, Upper Taieri, on the borders of the arid district of Central Otago. The other samples are included only in order to illustrate the influence of protein content on loaf-volume, and, not being representative of their particular varieties, their names are not given.

From a consideration of protein content it was said in the same article that "P 467, a sample of White Tuscan, contained a moderate amount of protein"—that is, its strength also would be expected to be moderate only; also that "the samples of Victor gave generally very good yields of flour, but in 1922 appeared in most cases to be lacking in strength. P 322 was a sample above the average for the variety."

* This sample of good average commercial "baker's" flour was obtained from a local warehouse. It was assumed, if this sample gave the same loaf-volume each time, that the necessary conditions were maintained during each baking with the requisite degree of accuracy.

EFFECT OF PROTEIN CONTENT ON LOAF-VOLUME.

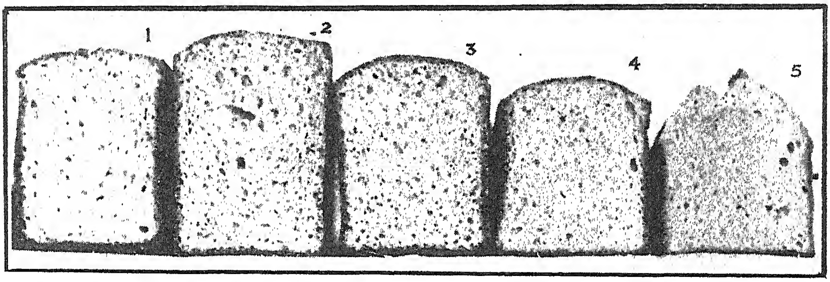


FIG. 1.

No.	Protein.	Half-loaf Volume.
	Per Cent.	c.c.
1	..	600
2	13·19	663
3	10·94	563
4	9·88	479
5	8·56	434

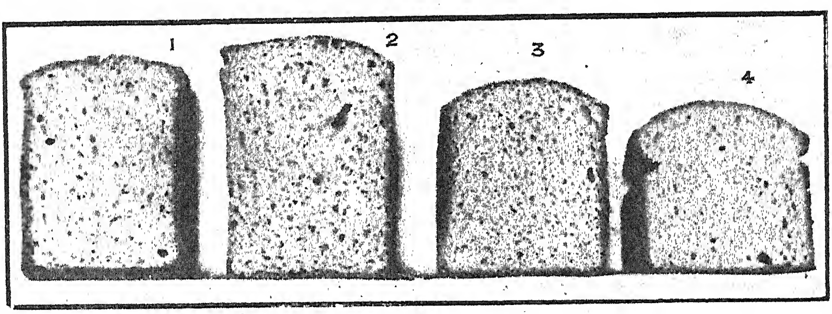


FIG. 2.

No.	Variety.	Protein.	Half-loaf Volume.
		Per Cent.	c.c.
1	Commercial "baker's" flour	..	600
2	Velvet (P 290)	13·19	663
3	White Tuscan (P 467)	9·88	479
4	Victor (P 322)	9·63	397

[*Photos by F. T. Leighton.*

Fig. 2 shows the results of the baking-tests of these two samples compared with the sample of Velvet (P 290), already illustrated, and a standard sample. The White Tuscan and Victor samples were the best all-round samples of their varieties received in 1922; it is fairly obvious that they do not compare favourably with the sample of Velvet, which was in strength only a little above the average for that variety in 1922. As a matter of fact, this sample of Victor is not even such a good wheat as its protein content would suggest. On comparing it with loaf No. 5, Fig. 1 (loaf-volume 434 c.c.*), it will be seen that its loaf-volume (397 c.c.) is less, though it contains over 1 per cent. more protein. This is due to factors which are not discussed in the present article. Loaf No. 4 shows the poor texture of the bread produced from this weak flour. While speaking of Velvet it may be interesting to point out that another sample of Velvet with protein 14·88 per cent. gave a loaf-volume of 690 c.c.

Of some Tuapeka samples it was said in the preceding article that "Thew . . . contained a very good amount of protein (12·50 per cent.)," and that "Marquis . . . in certain American States fetches highest prices. . . . The milling-yield [of this particular sample] is good, and it still contains a good percentage of protein." These two flours were baked because they were considered representative of the very interesting wheats obtained from Dumbarton, near Roxburgh, and which were actually grown at the Moa Seed-farm. Fig. 3 fully bears out the foregoing statements.

Referring to Fig. 3, for purposes of comparison these samples were photographed alongside the best samples of some other varieties received. Nos. 2 and 4 are obviously much better samples than 3 and 5, and there is no doubt which is of the most value to the miller, the baker, and the consumer.

One interesting point about this series (Fig. 3) is that Marquis, with a smaller protein content than Thew, yet produced a loaf of larger volume. Here is one of the exceptions to the rule that protein content is a measure of strength. At the same time there is never any doubt as to these two wheats producing flour of very good quality, even if one is an exception to the general rule. In this baking-test is perhaps the key to the statement quoted above that "Marquis fetches highest prices."

At the time when analytical figures only were available it was stated that "one of the outstanding samples milled in 1922 was the sample of Burbank's Super grown at Flaxton, Eyre County. Its protein content was as high as 14·44 per cent." The loaf baked from this flour is No. 3, Fig. 4. It will at once be seen that the baking-tests since carried out have quite confirmed the analytical results obtained some months ago. This sample of Burbank's Super produced a loaf of excellent volume. Alongside it (No. 2) is the poorest sample of wheat received in 1922, containing only 7·69 per cent. protein; this is illustrated, of course, only for purposes of comparison and of general interest, and is obviously not representative of its variety. No. 4 is the best sample of White Tuscan received at this Laboratory in 1922, and the loaf on the extreme right is the good sample of Velvet previously referred to. There is not much doubt about Burbank's Super being one of "the outstanding samples milled in 1922."

* c.c. = cubic centimetre ($\frac{1}{16}$ cubic inch approximately).

EFFECT OF PROTEIN CONTENT ON LOAF-VOLUME—*continued.*

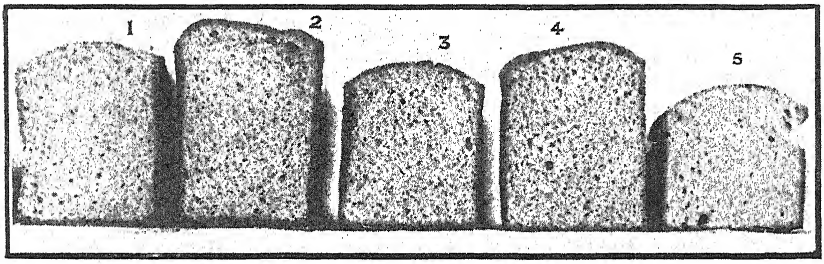


FIG. 3.

No.	Variety.	Protein.	Half-loaf Volume.
		Per Cent.	c.c.
1	Commercial " baker's " flour	..	600
2	Marquis (P 429)	11·44	666
3	White Tuscan (P 467)	9·88	511
4	Thew (P 432)	12·50	600
5	Victor (P 322)	9·63	397

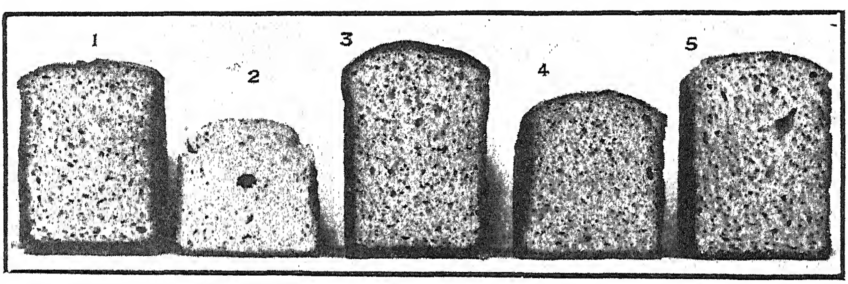


FIG. 4.

No.	Variety.	Protein.	Half-loaf Volume.
		Per Cent.	c.c.
1	Commercial " baker's " flour	..	600
2	Purple-straw Tuscan (P 319)	7·69	352
3	Burbank's Super (O 815)	14·44	726
4	White Tuscan (P 467)	9·88	511
5	Velvet (P 290)	13·19	663

[*Photos by F. T. Leighton.*

NOTE.—The relative sizes of the different loaves are not the same in all the photos —*i.e.*, one photo cannot always be compared with another as regards the apparent loaf-volumes. This, of course, does not apply to loaves in the same illustration.

GENERAL.

In connection with the whole question of experimental milling of wheat and testing of flours many pertinent questions might be asked. For instance :—

(1.) Does the yield of flour from the experimental mill correspond with the yield obtained when the wheat is milled on a commercial scale ?

(2.) Does the flour obtained experimentally produce on baking a loaf of good colour, appearance, and palatability ?

(3.) Do the wheats called "strong" and "medium strong" produce flours comparable with flours of a similar classification in other countries ?

(4.) Are the baking-tests comparable with the results obtained by the baker ?

(5.) Does the protein content of a flour bear any useful relationship to the loaf produced ?

It is thought that these and other questions can now be satisfactorily answered, and they will be briefly discussed in the same order.

(1.) It has already been stated that the percentage of ash is an indication of the skill shown in milling. According to various authorities the amount of ash in a straight grade flour (such as is milled in this Laboratory) should be at least 0·48 per cent.; it is said in effect that if a flour contains less than this amount the flour has not been so thoroughly removed from the grain as when it contains more. On the other hand, if it contains more than 0·90 per cent. ash the wheat has been overmilled.

The whitest flour comes from the centre of the grain; the strongest and best (the most glutinous) is situated just beneath the covering, which in milling is separated as bran, &c. The miller concentrates on separating as perfectly as he can this better-quality flour from the bran, otherwise microscopic bran-particles will find their way into the flour-stream and reduce its quality, colour, &c. The bran of the wheat-berry is considerably richer in inorganic substances (compounds of calcium, magnesium, phosphorus, potassium, &c.) than the flour; if bran therefore finds its way into the flour the inorganic content of the latter becomes greater. In determining the ash, one determines the amount of these inorganic compounds present, and in this way obtains an indication of the purity of the flour. If the ash is too high, a part of the bran has probably found its way into the flour; if it is too low—since the whiter central portion contains not only less protein but also a smaller amount of inorganic compounds—not enough of the richer outer layer of flour has been removed from the bran.

It will be seen on reference to Table II, published in the preceding article, that none of the samples milled here exceeds the limits mentioned above. Further than this, the flour, if it had not been satisfactorily separated from the outer husk of the grain, would have been of a dirty colour, and this would have shown itself in producing a bread of a dirty and disagreeable colour. Looking at this question from still another point of view, duplicate and triplicate results of

milling-tests agree as closely as can reasonably be expected (within 0·2 per cent.). This being so, it seems that the amount of flour obtained, being constant, is in effect a real measure of the flour available in the grain by milling processes under rigorously maintained conditions.

(2.) In answer to the second question it may be said that in every case where a flour was tested the bread in the samples above a certain strength has been of good texture when cut, and has possessed a colour as good as that of the commercial "baker's" flour which was baked with each series. The question of colour is interesting from a practical point of view, because in this Laboratory the mill is provided with nothing corresponding to the elaborate machines for cleaning the grain which form so indispensable and prominent a part of most modern mills; all cleaning is done here by hand, and at best must be imperfect.

The palatability of the strong samples has been as good as, and often better than, that of ordinary baker's bread. Externally the loaves were of a pleasing colour and well crusted; their texture was always found to be good with strong flours, decreasing in quality as the protein content became less, until finally the poorest sample might be said to have had no texture at all.

(3.) As regards comparison with samples of known and accepted good strength in other countries, the information in the left half of the following table was obtained from Bulletin 177 (1911) of the Kansas State Agricultural College Station. Kansas, it may be mentioned, is one of the leading wheat States of America.

No.	Strong Wheats tested in Kansas.			New Zealand Wheats.			
	Variety.	Protein.	Loaf-volume.	No.	Variety.	Protein.	Loaf-volume.
		Per Cent.	c.c.			Per Cent.	c.c.
58	Malakoff ..	15·65	1,330	O 815	Burbank's Super ..	14·44	1,452
65	Fife ..	12·24	1,290	P 308	College Hunters ..	12·19	1,292
67	Minnesota..	12·62	1,310	P 290	Velvet	13·19	1,326
68	Bearded Fife	10·68	1,300	P 429	Marquis.. ..	11·44	1,332
70	Minnesota..	12·22	1,260	P 431	Thew	12·50	1,200
76	Turkey Red	11·15	1,140	P 259	Dreadnought ..	10·94	1,200

It will be seen that, judged by loaf-volume, strong and medium-strong New Zealand wheats lose nothing when compared with typical Kansas wheats of the same classes. For purposes of comparison the local figures are calculated on the same amount of flour that was used in the American experiments.

(4.) The method of experimental baking is the method of the baker, and does not differ from his except in special cases to be mentioned. It is essential for purposes of comparison that the tests should give the measure of the strength of the flour and thus reveal differences of quality. Really comparative tests are attained, then, only by very exact control of all the processes and of temperature, no one flour being favoured more than another. A skilled baker no doubt adapts his methods to suit the different flours he uses, and by the processes of kneading and fermenting improves a weak flour. But this does not prevent that flour from being essentially a weak flour,

and of less value ultimately, not only from the point of view of bread-making, but also from that of the extra time and labour necessary to remedy its inherent defects. The experimental baking-test still remains a real criterion of the true value of a flour.

(5.) There is no doubt that high protein content is generally associated with high loaf-volume (*i.e.*, flour-strength). This is apparent from the photos and the accompanying data.

CONCLUSION.

Of the numerous baking-tests made, a selection is given here of those which pointed the moral. They have been used mainly because they were available when the photos were taken, and because also they illustrate the main points of this and the preceding article. Tests with other samples confirm these results.

It is necessary to point out that, though analogies and comparisons should not be pushed too far, members of a single series are strictly comparable. Where baking-tests are often carried out over a number of weeks, and on days of which some are colder than others, it is evident that exact control of all the conditions is most difficult. For instance, it was found impossible to obtain a compressed yeast which was always of the desired uniform good quality; and it is a well-known fact, too, that the yeast-plant is very sensitive to small temperature-changes. The writer can only agree with the authority who said, "With all the care and the corrections noted . . . the difficulties of obtaining strictly comparable tests are more evident to the one who has made the tests than to any one else." Baking-tests, however, are undoubtedly of great value, any appreciable differences in quality being at once apparent; and, being practical demonstrations, they are the more convincing on that account.

Variation in Milk Test during Lactation Period.—Experience shows that a cow calving in good condition will probably both milk well and test high at the commencement of the milking-period, and that there will be a gradual decline in both milk and percentage of butterfat until the surplus condition is worked off the body and the latter is reduced to normal producing condition. On the other hand, a cow freshening in poor condition may be expected to give both a light yield of milk and a low test until the body is replenished as the result of more abundant and suitable feed, &c. There will then probably be a gradual increase in both test and fat until the maximum fat-production for the season is reached at about the fifth month. Tests at the end of the milking season are found to be influenced by the condition of the cow, the nearness to calving, and the season of the year, and accordingly may fluctuate either up or down.—*W. M. Singleton, Director of the Dairy Division.*

Cheese-colouring.—Last season some difficulty was experienced in connection with the colour in coloured cheese. It was at first considered that the colouring was faulty, and in some instances the trouble disappeared when the colouring-material was changed. In other instances colouring-material which when used at one factory produced inferior-coloured cheese was used without any trouble at an adjoining factory. It would appear that some milks have a reducing effect on colour which does not obtain with other milks. The trouble is being investigated bacteriologically by the Department.

ASHBURTON EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1922–23.

F. E. WARD, Instructor in Agriculture, Christchurch.

IN this review of the past season's work at the Ashburton Experimental Farm much of the subject-matter is naturally a continuation of the two previous years' reports, and those interested are advised to study it in conjunction with the latter, which appeared in the *Journal* for September, 1921 and 1922 respectively. As in previous years, the notes have been compiled from the reports of Mr. J. G. McKay, Farm Overseer, who has carried out the work in his usual able manner.

PASTURE EXPERIMENTS.

Permanent Pasture.

Tall oat-grass having proved a failure as a permanent-pasture grass, this area was ploughed to the depth of 4 in. in the spring (1922), with the idea of trying another permanent grass-mixture. Owing to the presence of yarrow in the old sward the infested areas were cross-ploughed and grubbed once, the balance of the area remaining summer-fallowed on the one furrow.

The eradication of twitch and yarrow is a question of considerable importance in Canterbury, and no definite instruction can be laid down on this matter owing to variations of climate and soil. In the field under consideration, however, most of the yarrow was killed on the cross-ploughed section, and this method has much to commend it. Cross-ploughing cuts the turf into blocks which are thrown up in a rough state, thus allowing them to dry out during favourable weather. Continuous grubbing of yarrow and twitch-infested lands tends to consolidate the ground beneath the surface. Should wet weather then set in, stray pieces of roots are more likely to strike than if confined to the blocks as thrown up by cross-ploughing.

With the idea of ascertaining the subsequent effects of a deep ploughing on the growth and life of cocksfoot and clover, a portion of once-ploughed land was deep ploughed to a depth of 7 in. An application of 2 tons of carbonate of lime per acre was made to a portion of the field, a seed-bed was prepared, and the following mixture sown on 20th March last: Perennial rye-grass, 6 lb.; cocksfoot, 15 lb.; crested dogstail, 2 lb.; red clover, 5 lb.; white clover, 2 lb. It is intended to carry out top-dressing experiments on this area at a later date.

Paspalum.

An attempt was made to establish *Paspalum dilitatum.* A mixture of 5 lb. paspalum, 20 lb. Italian rye-grass, and 2 lb. red clover was sown on 22nd September, 1922, but, though a good strike of rye-grass and clover has resulted, there is no sign of paspalum at date of writing. It is probable that the climate of Canterbury is too cold for this grass.

Top-dressing Old Pasture.

This pasture was sown down in 1917. It was divided into five plots in 1921, the subsequent treatment being as follows :—

Plot No.	Top-dressing, per Acre.	Date of Application.	Top-dressing, per Acre.	Date of Application.
1	10 cwt. slaked lime ..	19/8/21	5 cwt. burnt lime ..	2/6/22
	2 cwt. superphosphate ..	7/9/21	2 cwt. superphosphate ..	31/8/22
2	Control (no dressing) ..	..	Control (no dressing) ..	..
3	2 cwt. superphosphate ..	7/9/21	2 cwt. superphosphate ..	31/8/22
4	4 cwt. Nauru rock phosphate	7/9/21	4 cwt. Nauru rock phosphate	31/8/22
5	1 cwt. blood, 1 cwt. super	7/9/21	1 cwt. blood, 1 cwt. super	31/8/22

Contrary to the previous season's experience, the effect of lime and manures was very noticeable during spring and early summer. The growth of white and suckling clover was remarkable, especially on the lime and super plot, where all previously vacant spaces were occupied by clovers. Similar spaces on the control plot were filled by hair-grass, moss, and hawkweed.

These plots were grazed in conjunction with an adjoining paddock of young rye-grass and red clover, and the sheep at first preferred the old top-dressed pasture. In subsequent grazings both pastures were about equally favoured, with the exception of the control plot on the old pasture, which remained practically untouched. Right through the season the line where the control meets the manured plots has been clearly defined, especially so by the amount of roughage which remained on it during the autumn and winter. It appears that the plot which received lime and superphosphate was most relished by stock.

Temporary Pasture.

This consisted of two plots of 5 acres each—plot 1 being spring-sown with rape, and plot 2 autumn-sown after rape.

In the 1921–22 report it was stated that plot 2 showed the better sole of rye-grass, but plot 1 the better strike of clover. Plot 1 is now a much-improved pasture, considerable filling-in of rye-grass having taken place ; the clover, however, is rather scanty. Plot 2 (autumn-sown) is better in this respect, particularly at the southern end, where the previous pasture contained a predominance of cocksfoot. This end of the pasture is apparently much relished by stock, all rye-grass, including heads, being closely cropped. The good stand of clover is probably accounted for by the heavy cocksfoot turf which was ploughed in, but that the incorporation of vegetable matter improves the palatability of a pasture has not previously been noted.

COCKSFOOT-SEED PRODUCTION.

As related in a special note in the *Journal* for July, 1922, cocksfoot grown on the Danish system—in wide drills and intercultivated—has done exceptionally well on the Ashburton Farm. This area was closed in autumn (1922) after having been cultivated, and was again cultivated during August. The seed-crop was harvested on 26th December and threshed last month. The area of 2·4 acres yielded 490 lb. of seed,

or 204 lb. per acre, not machine-dressed. The straw was shorter than that of the previous season's crop, and the heads apparently not so well filled. The weather was dry during the filling and ripening period. The aftermath has been grazed with sheep.

CEREALS.

Wheat Selections.

Crop results of wheat selected by officers of the Department and members of the farm advisory committee from 180 varieties grown on the farm in the previous season are tabulated below. The date of sowing was 30th May, 1922. Seeding was at the rate of 1½ bushels per acre, and the manuring superphosphate at 1 cwt. per acre.

Variety.	Date harvested.	Yield per Acre.			
		Firsts.		Seconds.	
		Bus.	lb.	Bus.	lb.
Snowdrop	19/1/23	41	34	3	25
Pearl	10/1/23	40	51	3	35
White Tuscan (Cheviot)	10/1/23	37	59	1	4
Velvet (Ngapara)	19/1/23	37	16	2	52
Jumback	8/1/23	36	54	2	9
Red Fife	10/1/23	36	54	3	35
Johns Winter Fife	10/1/23	36	33	2	52
Essex Conqueror	19/1/23	36	1	2	52
Turretfield Eclipse	8/1/23	35	1	2	30
Queen Fan	8/1/23	35	50	4	18
Queen Fair	8/1/23	35	32	2	9
Kinver Red	19/1/23	35	7	2	52
Velvet Chaff	10/1/23	35	7	..	
Major	8/1/23	34	24	2	9
Burbank	10/1/23	30	48	3	13
Zealand	10/1/23	30	26	4	18
Echo	30/12/22	30	6	4	18
White Fife	8/1/23	29	23	2	30
Marquis	8/1/23	29	23	1	47
Salter's Early	30/12/22	28	40	2	9
Triumph	10/1/23	Not taken		..	
Bayah	Cut out (poor)	..		..	
Bunge Federation	,,	..		..	

Oats.

A number of varieties procured from the Irish Department of Agriculture have been sown for two seasons, but none of the samples of grain produced has as good an appearance as a well-grown sample of many clean commercial lines. The variety Victory showed promise of being a good green-feed oat in the early stages, but it rusted badly later. The varieties, being pedigree strains, were Black Tartar, Banner, Black Mogul, and Victory.

Barley.

Five varieties received from the Irish Department of Agriculture were sown, and several useful samples procured. One variety producing a long berry of the Cape-barley type was culled, but the following are being given a further trial: Archer, Archer-Goldthorpe, Archer-Sprat, and Goldthorpe.

Cereals and Seed Vetches.

This experiment was planned to ascertain which is the best cereal to sow with vetches to prevent lodging of the latter, also to find out if any cereal would ripen and cast its seed earlier than the vetches, thus leaving a comparatively clean sample of vetch-seed. Four quarter-acre plots were sown on the 25th August with Scotch vetches at 1½ bushels per acre, together with the following cereals also at 1½ bushels per acre: Plot 1, Solid-straw Tuscan wheat; plot 2, Cape barley; plot 3, Emerald rye-corn; plot 4, Garton oats. Superphosphate at 2 cwt. per acre was used for manuring.

The plots were harvested on 3rd February. As a holding-up crop the order of preference was—(1) wheat, (2) rye-corn, (3) oats, (4) barley. None of the cereals had cast all its grain when the vetches were ready for harvesting, although probably two-thirds of the oats in plot 4 had shaken out.

TURNIPS AND RAPE.

A comprehensive experiment was planned with these crops, both manurial and seed tests being embodied. Owing to the ravages of aphis and diamond-back moth during a dry spell the crops were practically ruined. In the early stages, however, New-Zealand-grown rape and turnip seed both compared very favourably with the imported. Every plot which had an application of manure grew larger plants than were grown on the controls, but, as related in the *Journal* for May last, heavy applications of either superphosphate or basic super in contact with the seed lowered the germination considerably.

LUCERNE.

The first growth of the season showed great promise, the manured portion being particularly forward, but the crop was caught by a late frost when almost ready to cut, and was practically ruined. In all subsequent cuts the manured plots gave heavier yields than the unmanured plots. Grazing-tests were carried out on an area of 8 acres, the lucerne standing heavy stocking quite well. The carrying-capacity of this area, as represented by the sheep grazed during the growing season, gave the equivalent of 6·73 sheep per acre per annum.

There is evidently a certain amount of danger from bloat in grazing lucerne, particularly in the case of ewes and lambs, and lambs just off their mothers. Over a period of five weeks' pasturing five strong forward lambs and one store lamb died out of a total of 160. In the case of the five forward lambs death occurred on a morning following rain. The sixth lamb was scouring rather badly, and would possibly have died on any strong feed. Similar cases were experienced when pasturing ewes and lambs on the lucerne. Rain had fallen on two nights only during the pasturing-period, and on each day following one ewe died. Good-constitutioned wethers with some condition can be pastured safely enough on lucerne, and they do well.

It was also noticed that sheep's burnet growing in an adjoining gully was eaten more readily than the lucerne by all ages of sheep, and even the weed grasses and gorse hedges came in for their share of attention. It seems evident that lucerne alone did not satisfy the sheep, but whether this preference for other food indicates some deficiency in lucerne or simply a desire for a change of diet is largely a matter of conjecture.

POTATOES.

Continuing the previous season's trials on cut *versus* uncut seed the following results per acre were obtained :—

Variety.	Uncut Seed.				Cut Seed.			
	Table.	Seed.	Pig.	Total.	Table.	Seed.	Pig.	Total.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Dakota	5·05	1·52	0·36	6·93	3·95	0·80	0·24	4·99
Arran Chief	3·47	4·23	1·86	9·56	2·98	2·48	0·87	6·33
Reading Russet	10·44	4·48	1·99	16·91	9·07	3·24	1·49	13·80
Snowflake	11·31	2·87	0·99	15·17	10·70	1·74	0·23	12·67
Snowdrop	6·47	6·24	2·74	15·45	4·97	6·84	1·86	13·67
Bresee's Prolific	7·34	2·74	0·99	11·07	8·30	3·55	1·42	13·27
Manhattan	3·36	2·24	0·75	6·35	3·20	1·39	0·49	5·08
Up-to-date	1·86	1·74	0·86	4·46	1·84	2·48	0·74	5·06
British Queen	4·00	2·46	0·96	7·42	3·25	1·44	0·62	5·31
Average, 1922–23	5·92	3·16	1·27	10·36	5·36	2·66	0·88	8·91
Average, 1921–22	1·68	2·66	1·07	5·42	1·37	2·13	1·87	4·37
Average, 2 years	..	..	..	7·65	..	..	..	6·41

It will be noticed that only in the case of Bresee's Prolific and Up-to-date did the cut seed exceed the uncut in yield. The New Era variety was tested but not dug in the 1922–23 season.

BACTERIAL CONTAMINATION OF MILK AND CREAM.

HINTS FOR DAIRY-FARMERS.

L. S. BARRELL, Farm Dairy Instructor, Hokianga.

MILK as secreted in the udder of a healthy cow is germ-free. Contamination may take place in various ways: first, during the act of expressing the milk from the teat, as the opening from the milk-sinus to the outside is of such a nature that bacteria adhering to the mouth of the milk-duct are washed away with the first milk and therefore contaminate the whole milking. It will thus be seen that careful washing of the cow's udder is the first step in the endeavour to produce a bacterially clean milk. Thereafter there are different sources of contamination that can, with thought and care, be eliminated to a large extent. The chief sources lie in the use of unclean dairy utensils and the air of the milking premises.

Too much stress cannot be laid upon the importance of thoroughly washing all dairy utensils, and finally scalding them with boiling water and retaining them in this boiling water for a few minutes.

Contamination from the air is effected by the multitude of fine particles of dust that are ever present in the atmosphere of many

milking-sheds, each particle carrying its burden of living organisms which await more favourable surroundings, being unable to multiply until deposited in a medium containing the necessary moisture and food elements. These favourable conditions are found in milk, and the bacteria that thus find their way into the milk that is left standing about the dairy premises multiply with astonishing rapidity. Contamination by dust can to a large extent be prevented by having concrete floors which are kept well washed down, and by the immediate separation of the milk and removal of the cream, as soon as separated, to a cool well-ventilated detached dairy.

Leaving aside the pathogenic or disease-causing bacteria, we may briefly consider that class of organism responsible for most of our defective home-separated cream—namely, the lactic-acid and particularly the gas-forming groups. Each of these types is represented by varieties or species, which may have different effects on the flavour, texture, or keeping-qualities of the dairy-product.

The gas-forming bacterium gains access to the milk chiefly during the milking operation, through improper washing of the cow's udder or not washing the udder at all; dirty hands of the milker; and most likely through the dirty habit of wet milking, when the milk is badly contaminated by the drippings from the hands. The organism becomes attached to the teats and udder of the cow through contact with the earth when lying down, and particularly during the dry part of the season when cows are searching for water or succulent feed in swamps and about stagnant bog-holes. Its presence in cream is detected by fermentation, which usually begins to manifest itself within twenty-four hours, small bubbles of gas appearing on the surface. In bad cases it will be noted that the cream appears of a yeasty nature, and that its volume has visibly increased, due to displacement by the large volume of generated gases held in suspension. Cream when in this condition is not suitable for acceptance at the factory for manufacture into butter, as the fermentation is accompanied by a decidedly "off" flavour, and the aroma will vary with the particular species of gas-forming bacterium with which it is infected. Cream only slightly affected in this way has a flavour that the average dairyman will put down to feed, and he will not concern himself about the matter further. As a matter of fact, however, it has been shown that in nine cases out of ten where it is assumed that feed-flavour is present the defect is directly due to the presence of gas-forming bacteria, and therefore controllable.

During the hottest weather of last summer a local dairy-farmer asked for the writer's assistance in an endeavour to trace the cause of a peculiar flavour in his cream that had kept his grade down when he was making every effort to produce a superfine article. This persistent flavour would have been commonly classed as having origin in the feed, but it was proved on investigation to be due to bacteria of the gas-forming type, although gas was not formed to such an extent as to show fermentation. It was found that the dairyman had his utensils, milking-machine, dairy, and shed in first-class condition as regards cleanliness. A curd test was made from a composite sample of the milk of the whole herd, and this showed after the usual incubation period that the milk was affected by gas-forming bacteria.

Thus the line of action was quite clear. The following day the milking-machine, separator, and other utensils were thoroughly sterilized with boiling water, and the writer took charge of the four subsequent milkings covering the period from which the cream was sent to the factory, personally washing and wiping dry each cow's udder, and making this operation more effective by the addition of a small quantity of an odourless disinfectant to the washing-water. After each milking the machine plant, separator, cream-can, and other utensils were thoroughly washed and then sterilized with boiling water. Immediately after being separated the cream was removed from the separator-room to a dairy situated some distance from the shed, and therefore away from any likely source of contamination. Each skimming was kept separate, and stirred twice daily with a metal stirrer. Just before removal to the cream-stand to await transport to the factory the various skimmings were placed in a clean sterile can. From that day onward this farmer's cream has not failed to grade superfine, and has graded as high as 93.

Mention may be here made of a micro-organism that frequently causes trouble and was complained of by several dairy-farmers during last season—the one responsible for ropy or slimy milk and cream. Cream affected by this bacterium assumes a viscid or slimy nature, and its colour becomes much paler, which at once indicates to the trained eye that something is amiss. This trouble is not as a rule accompanied by any objectionable flavour, but rather by a lack of flavour—that is, the cream does not possess that full rich flavour found in the product that grades superfine. As cream thus affected will certainly not make first-class butter, it is either classed second grade or rejected altogether, depending on the extent of its infection. This organism is introduced into the milk chiefly by means of the washing-up water, particularly during the driest period of the season, when sources of water-supply frequently become stagnant and are mostly infected. For this latter reason also the germ can be introduced by improper washing of the cows' udders. Its presence in milk or cream can be prevented by the same treatment as that mentioned in the case of gas-forming bacteria.

Finally, it is necessary to emphasize the importance of cooling for controlling the bacterial content of milk or cream. It is a well-known fact that those bacteria that form gas make their maximum increase at separating temperature—namely, between 80° and 95° F.—while during very hot weather it is not unusual to find cream that has not been run over a cooler, with a temperature of over 80° some considerable time after separation. With a well-designed cooler it is not difficult to get the temperature well below 70°, and in such circumstance gas-forming bacteria are outstripped in their race for existence by the less harmful lactic-acid germs, which eventually crowd out the former.

Acid formed in cream by the lactic-acid bacterium, unless present to such an extent that the acidity is very high, will not affect the grade of the product, providing it is possessed of a good clean flavour, fine texture, and colour, indicating that it has been well looked after and produced under sanitary conditions.

MARTON EXPERIMENTAL AREA.

OPERATIONS FOR SEASON 1922–23.

J. W. DEEM, Fields Instructor.

THE spring of 1922 was very good in the Marton district, and all crops at the experimental area were sown under favourable conditions. Average strikes were obtained, and the prospects for good crops looked bright. The weather, however, broke in December and continued wet right through the autumn, consequently crops did not ripen evenly and harvesting operations were very trying. The cereal crops were saved in fair condition, but later-maturing crops such as peas and tares suffered badly.

OATS MANURIAL TRIAL.

Ten acres of Algerian oats were sown at the end of April, 1922, fed off once in June, and harvested in December. The area was divided into five 2-acre blocks, a different manure being used on each area. Following are the different manurial applications, together with the weights of chaff per acre secured from the different plots :—

Plot 1—1 cwt. superphosphate and ½ cwt. sulphate of potash per acre, 2 tons 4 cwt. chaff ; plot 2, half super and half bone char, at 1½ cwt. per acre, 2 tons 7 cwt. chaff ; plot 3, half super and half Nauru rock phosphate, at 1½ cwt. per acre, 2 tons 5 cwt. chaff ; plot 4, 1½ cwt. Nauru phosphate per acre, 2 tons 10 cwt. chaff ; plot 5, 1½ cwt. super per acre, 2 tons 6 cwt. chaff.

It will be noticed that Nauru rock phosphate shows rather the best return, but all the manures gave very even yields.

WHEAT.

Three acres of Major variety were grown, 2 of which were sown on 7th September—1 acre after peas and 1 acre after rape, both the peas and rape having been fed off with sheep ; the other acre was sown on 2nd October. Marquis and Yeoman, 1 acre of each, were sown on 7th September. The following table gives yields and dates of harvesting :—

Variety.	Date of Harvesting.	Yield per Acre.
		Bushels.
Major (after peas)	1st February	46·6
Major (after rape)	1st February	42·0
Major (late sown)	12th February	30·0
Marquis	1st February	29·2
Yeoman	1st March	13·3

The following averages have been recorded at the Marton Area : Major, four years, 43¼ bushels ; Marquis, three years, 35 bushels ; John Brown, three years, 28⅔ bushels per acre.

Yeoman is purely a winter wheat, and as the seed was not received until August it had to be spring-sown. It germinated and stooled out well, but made very little growth until after Christmas, when it grew very fast. In the later stages of its ripening it was the only grain standing in the district, and birds played havoc with it. This accounts for the low yield.

BARLEY.

An area of $3\frac{1}{3}$ acres of Black Skinless barley was sown on 6th October and harvested on 21st January. It yielded 26·3 bushels per acre. Owing to the abnormal season even this crop was longer in ripening than usual, and was considerably knocked about.

PEAS.

The three varieties grown were Grey Partridge, Early Minto, and grass-pea. The two former were badly attacked with collar-rot and yielded poorly. The samples were also very poor. The grass-pea was a long time in maturing owing to wet season. At time of writing they have not yet been threshed, as it has been impossible to get the machine on to the ground.

FEEDING-TESTS WITH SUMMER FODDER CROPS.

Four acres of fodder crops were grown, consisting of 1 acre grass-peas and tares, 1 acre Japanese millet, 1 acre Japanese millet and rape mixed, and 1 acre Hickory King maize. These were fed off with sheep and lambs, but owing to the class of stock available (mostly cull Lincolns) the results are of no moment.

HAYING-PASTURE.

Five acres of temporary pasture—Italian rye-grass and red clover in its fifth year—were cut for hay on two occasions. This field was limed with 10 cwt. per acre of carbonate of lime at end of July, 1921, and 1 acre was top-dressed with 2 cwt. per acre of superphosphate in September of the same year. The field, with the exception of that part which received super in 1921, was in August, 1922, divided into plots and top-dressed, part with super and part with Nauru rock phosphate, both at the rate of 2 cwt. per acre, while two small areas were left untouched as controls.

The whole field was closed up on 16th October, 1922, and cut for hay on 2nd January, 1923. During practically the whole time the field was closed the plots which had received superphosphate could be picked out easily, the pasture being of a darker colour than that on the other plots, with much more clover showing. Prior to cutting several average areas were weighed on each plot, the following being the average weights of green material per acre: Plot top-dressed with 2 cwt. superphosphate in September, 1921, 8 tons 7 cwt.; plot top-dressed with 2 cwt. superphosphate in August, 1922, 9 tons; plot top-dressed with 2 cwt. Nauru phosphate in August, 1922, 7 tons 11 cwt.; control area, 7 tons 14 cwt. The average weight per acre of green material over the whole area was 8 tons 3 cwt.

It is interesting to note that this area was sown in temporary pasture in November, 1918, with 25 lb. Italian rye-grass and 5 lb. red clover. Each year since it has been cut for hay, and in addition has grazed on the average two and a half sheep per acre for the whole period. At the end of four years the stand is still fairly strong, both the rye-grass and clover being good. No doubt the rye-grass has done considerable reseeding. The results from this area demonstrate what can be taken from heavy Marton land by careful treatment.

Following are the returns of pressed hay for the past four seasons, also the amount of green material required to make 1 ton of hay: 1919–20—3 tons 10 cwt. hay per acre, 4·3 tons green material to 1 ton hay; 1920–21—3 tons 15 cwt. hay per acre, 4·7 tons green material to 1 ton hay; 1921–22—3 tons 14 cwt. hay per acre, 4 tons green material to 1 ton hay; 1922–23—2 tons 12 cwt. hay per acre, 4·3 tons green material to 1 ton hay (the figures for this season are calculated from green material).

A further area of 11 acres sown with a mixture of 15 lb. Italian rye-grass, 10 lb. perennial rye-grass, and 5 lb. red clover per acre on 6th April, 1921, and top-dressed with several different fertilizers in September, 1921, was closed up on 19th September, 1922, and cut for hay on 8th December. It was then closed up again, and cut a second time at the end of February, 1923. Prior to each cutting average weights were taken, and the following table gives the quantities of green material per acre on the respective plots:—

Top-dressing.	First Cutting.		Second Cutting.		Average.	
	Tons	cwt.	Tons	cwt.	Tons	cwt.
Basic slag at 3 cwt. per acre, on 5/9/21 ..	14	2	10	16	12	9
Nauru rock phosphate at 3 cwt. per acre, on 2/9/21	12	13	8	9	10	11
50-per-cent. phosphate at 3 cwt. per acre, on 13/9/21	13	10	7	12	10	11
Control (not top-dressed)	12	15	8	7	10	11
Average weights per acre over whole field ..	13	5	8	16	..	

LUCERNE.

The lucerne stand of 2 acres was cut three times during the season. Owing to the exceptionally wet season it was not possible to cut this crop on the dates when it was at its best with any degree of certainty of saving the hay. Had the weather been favourable at these times a fourth cutting for the season could have been secured.

As the Marton land is not considered very suitable for lucerne the record of the last three years is interesting, and indicates what can be done on such land if grazing is avoided. A comparison between this lucerne area and the adjoining temporary pasture previously referred to (which was sown the same year) shows that up to the present, and taking into consideration the grazing, the temporary pasture has given the better returns. The results per acre from the older area, sown in December, 1918, are as follows:—

Season.	Broadcast.		7 in. Drills.		14 in. Drills.		21 in. Drills.	
	Tons	cwt.	Tons	cwt.	Tons	cwt.	Tons	cwt.
1920–21	17	0	17	5	17	6	14	14
1921–22 (four cuttings)	25	10	19	14	22	12	21	8
1922–23 (three cuttings) ..	18	15	17	13	17	18	16	13
Average of three seasons ..	20	8	18	4	19	5	17	12

The later area, sown in December, 1919, in 21 in. drills, has given the following results: Grimm variety, with manure, 1921–22, 16 tons 12 cwt.; 1922–23, 14 tons 1 cwt.; average of two seasons, 15 tons 6½ cwt. per acre. Grimm, without manure, 1921–22, 14 tons 12 cwt.; 1922–23, 12 tons; average, 13 tons 6 cwt. per acre. Marlborough variety, with manure, 1921–22, 13 tons 17 cwt.; 1922–23, 13 tons 3 cwt.; average, 13 tons 10 cwt. per acre. Marlborough, without manure, 1921–22, 14 tons 12 cwt.; 1922–23, 11 tons 10 cwt.; average, 13 tons 1 cwt. per acre.

It should be mentioned that it has not been possible to cultivate the lucerne on the Marton Area, the land being either too wet or too hard.

GENERAL.

One acre of grass-peas was grown for seed purposes, but the crop has not yet been threshed.

Tares self-sown in the autumn were fed down twice with sheep during the winter and harvested early in the new year, yielding well. On land like that at Marton autumn sowing of tares should be good practice, for in addition to the benefits of early maturing they provide quite an amount of good sheep-feed.

A further area of 13½ acres has been sown down in temporary pasture for soil-fertility purposes. It is also proposed to sow an area of imported wild white clover when the seed which is on order comes to hand.

Chewings fescue threshed out very well last season, and at the Department's seed-testing station gave higher germination tests than for many years previously.

Compensation for Condemned Stock.—During the last financial year compensation to the amount of £12,986 was paid out for 5,183 animals condemned in the field under the Stock Act, and in addition the sum of £12,657 was paid for carcases or parts of carcases condemned on inspection at time of slaughter under the provisions of the Slaughtering and Inspection Act, making the total amount for which the Consolidated Fund became liable £25,643.

Nauru Phosphate.—Since the acquisition of the Nauru and Ocean Island phosphate-deposits by Britain, Australia, and New Zealand the importation of phosphate-rock from that source into this Dominion has been in the hands of the Department of Agriculture. The business having become well established, with the Dominion now absorbing its full quota, arrangements were made for its conduct to be placed in the hands of the Phosphate Commission as from 30th June last. The arrangement between the Department and the commercial agents terminated at the same time, the agents now acting for the Commissioners only.

TESTING OF PUREBRED DAIRY COWS.

MAY–AUGUST C.O.R. LIST.

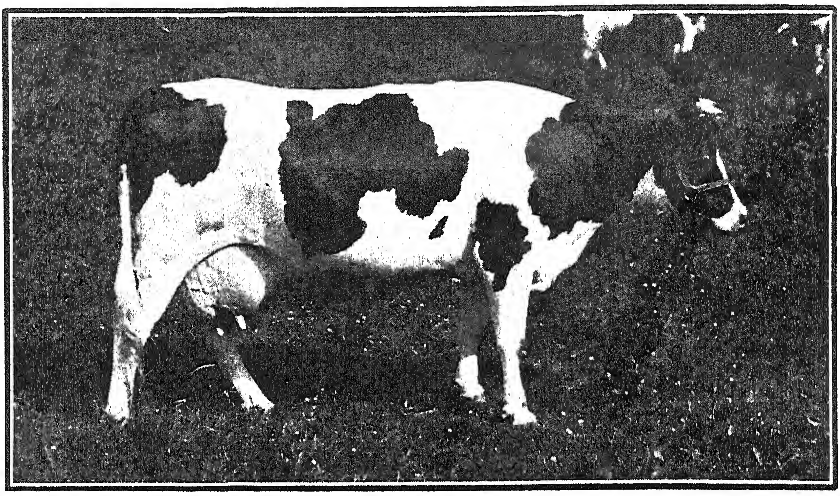
Dairy Division.

THE following list comprises the records of cows which received certificates during the four months May to August, 1923. It will be seen that several noteworthy records have been made, apart from that of Hilda Minto de Kol previously noticed in the *Journal*.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Alfalfa Cicero Fontaine	F. J. Saxby, Ohaupo . .	2 69	247·4	365	11,238·4	665·74
Lola	Mrs. E. M. Spinley, Palmerston North	2 91	249·6	365	8,356·2	520·64
Viola's Lady Mercedes	H. C. Sampson, New Plymouth	1 302	240·5	365	7,273·9	457·90
Bridge View Duchess	A. L. Hooper, Mahoe . .	1 260	240·5	365	7,383·9	432·99
Larking	R. Hicks, Hawera . .	2 16	242·1	311	6,900·7	427·83
Pelynn Daisy . .	L. K. Tarrant, Ngaere	2 24	240·9	310	6,369·2	421·77
Silverdale Magnet . .	G. Hodgson, Whakapara	1 204	240·5	365	6,510·1	410·92
Signor's Lilac . .	G. Buchanan, Paeroa	2 11	241·6	325	7,597·3	404·21
Spring Meadows Lavender	D. M. Finnie, Westmere	1 288	240·5	365	7,173·5	380·24
Rosy Creek Gaillardia	A. L. Hooper, Mahoe	1 307	240·5	330	6,916·2	379·86
Burnside Golden Chimes	S. J. Hollard, Rowan	2 4	240·9	317	7,354·0	353·13
Elfin Grange Dairymaid	E. S. Walker, Stratford	1 360	240·5	327	6,494·7	347·31
Oakleaf	R. Hicks, Hawera . .	1 307	240·5	327	6,530·7	345·84
Sweet Lass . .	H. T. Mellow, Stratford	2 25	243·0	292	5,555·3	335·18
Miro Meadows Tulip	A. A. Ward, Tariki . .	1 324	240·5	330	5,536·0	311·76
Meadowvale Petrova	S. J. Robinson, Hinuera	2 24	242·9	303	5,389·0	303·59
Rawhitiroa Leafless	H. M. May, Hukerenui	2 3	240·8	273	5,803·2	302·04
Rawhitiroa Cushla . .	H. M. May, Hukerenui	2 7	241·2	263	5,150·7	290·56
Senior Two-year-old.						
Kuku Lily	R. L. Horn, Ohau . .	2 325	273·0	349	11,747·7	603·20
Roslyn Genoa Fox . .	J. Harris, Bombay . .	2 273	267·8	365	9,278·9	517·55
Joyful's Joybells . .	J. G. Robertson, Eltham	2 164	256·9	365	8,638·9	497·30
Nanny	A. E. Phillips, Maunu	2 291	269·6	327	8,824·5	493·69
Holly Oak's Fairy . .	M. V. Reeve-Smith, Aria	2 119	252·4	365	8,129·6	478·58
Netley Girl . .	J. Nicholson, Manakau	2 285	269·0	357	8,313·8	445·93
Maori Pulchra . .	A. G. Somervell, Takapau	2 234	263·9	365	6,121·1	406·56
Delectation . .	G. Buchanan, Paeroa	2 291	269·6	365	7,573·0	404·10
Holly Oak's Alma . .	W. P. Begg, Arapohue	2 130	253·5	311	5,848·5	380·70
Rosetree's Miracle . .	W. Glaister, Te Kuiti	2 340	274·5	320	5,364·5	355·85
Swansea Myrtle . .	S. Atkinson, Papatoetoe	2 313	271·8	276	5,274·7	293·69

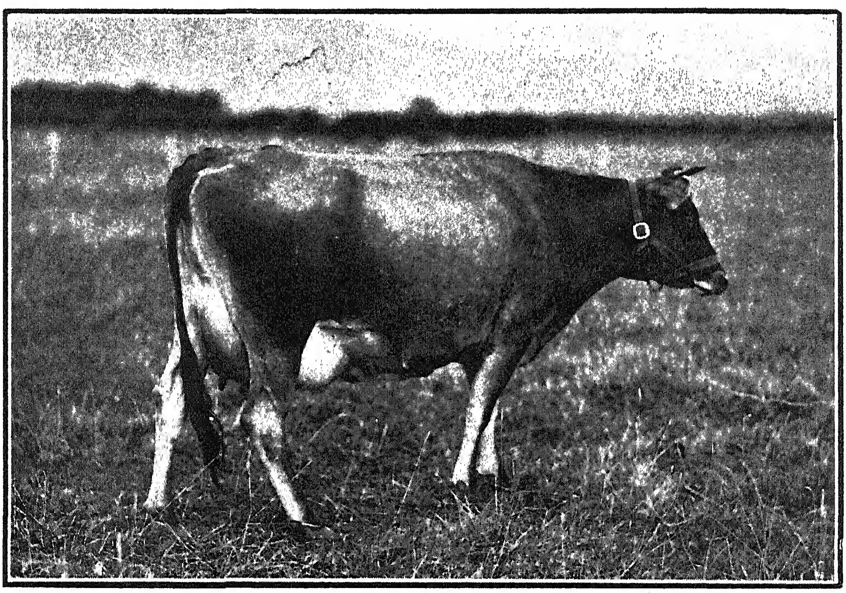
LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
JERSEYS—*continued*.						
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
La Corsica.. ..	F. J. Saxby, Ohaupo	3 115	288·5	356	8,699·1	525·07
Mira	T. M. Remington, Westmere	3 341	274·6	351	7,774·8	485·65
Hawkesbury Butterfly	A Buchanan, Palmerston North	3 267	303·7	308	8,275·0	460·01
Mangaoraka Princess	E. S. Walker, Stratford	3 352	312·2	323	8,098·9	457·31
Vaultress	G. E. Cowling, Manaia	3 346	311·6	326	7,405·9	451·46
Gleam's Eden ..	S. Atkinson, Papatoetoe	3 33	280·3	293	6,276·8	397·34
Hawkesbury Graceful	A. Buchanan, Palmerston North	3 213	298·3	285	5,689·6	339·55
Hillsbourne Picotee..	A. Buchanan, Palmerston North	3 193	296·3	363	5,804·3	334·18
General's Lady ..	E. H. Linnell, Midhirst	3 346	311·6	313	5,816·6	316·65
Eileen's Betty ..	S. Atkinson, Papatoetoe	3 324	309·4	310	5,453·7	315·20
Four-year-old.						
Berenice	R. Haylock, Stratford	4 2	313·7	365	9,358·0	577·00
Kuku Lilyvale ..	R. L. Horn, Ohau ..	4 314	344·9	257	11,089·4	576·15
Reid Park's Maiden	R. F. Wilkinson, Pukekohe	4 255	339·0	341	10,151·4	534·85
Roslyn Pearl ..	J. Harris, Bombay ..	4 210	334·5	281	7,080·2	436·81
Ventricosa.. ..	G. A Gamman, Marton	4 271	340·6	296	6,471·9	378·16
Mature.						
Regal of Jersey Meadows	H. H. Phillips, Dannevirke	5 272	350·0	365	10,780·8	547·77
Charm's Mayflower ..	G. Buchanan, Paeroa	6 295	350·0	322	9,401·5	496·99
British Maid of O.K.	E. S. Walker, Stratford	5 357	350·0	309	10,803·8	479·21
Sunstorm	F. J. B. Ryburn, Paterangi	5 55	350·0	308	8,720·4	469·17
Swan Cup	J. Harris, Bombay ..	6 255	350·0	365	7,561·6	434·84
Kuku's Sis ..	R. L. Horn, Ohau ..	6 350	350·0	287	8,583·5	420·53
Record of Bulls ..	G. A. Gamman, Marton	6 356	350·0	319	7,004·4	409·23
Nora's Garnet ..	A. C. Mannington, Maungatapere	7 38	350·0	275	7,655·0	372·84
Treasure's Lass ..	C. B. Herrold, Waiuku	8 11	350·0	349	6,416·2	368·73
FRIESIANS.						
Junior Two-year-old.						
Queen Mercena Posch	N. P. Nielsen, Tiakitahuna	1 233	240·5	365	12,199·4	425·95
Fencourt Lady ..	J. H. Jamieson, Cambridge	1 341	240·5	264	8,427·8	314·28
Anawhata Hengerveld de Bonte	P. F. Boucher, Kumeu	2 99	250·4	313	7,060·7	260·22
Senior Two-year-old.						
Pietertje Dutchland Abbekerk	H. R. Green, Kairanga	2 318	272·3	353	19,164·0	675·21
Bainfield Tirania 2nd	W. D. Hunt, Invercargill	2 332	273·7	365	13,972·9	555·30
Cordyline Blanche ..	G. Aitchison, Kaitangata	2 210	261·5	365	15,248·5	553·89



ROSEVALE QUEEN DAPHNE (H. NORTH AND SONS, OMIMI).

C.O.R., 1923, Friesian Junior Four-year-old Class: 20,050·31 lb. milk, 805·54 lb. butterfat, in 365 days.



DELILAH (JAMES NICHOLSON, MANAKAU).

C.O.R., Jersey Three-year-old Class: 10,916·35 lb. milk, 641·19 lb. butterfat, in 365 days.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*					
Senior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Brookdale Johanna Canterbury	S. Knight and Sons, Ongarue	2 209	261·4	365	13,218·5	508·25
Tokaora Galatea Segis	R. H. Hammond, Ohakune	2 270	267·5	285	12,866·8	425·86
Senior Three-year-old.						
Woodlyn Grace Champion	T. C. Barbour, East Tamaki	3 347	311·7	361	18,596·6	570·67
Woodlyn Lady Burke de Kol	T. C. Barbour, East Tamaki	3 222	299·2	365	16,223·8	542·81
Junior Four-year-old.						
Monavale Aurora Pietertje	S. Knight and Sons, Ongarue	4 62	319·7	365	14,401·7	548·85
Senior Four-year-old.						
Cluny Netherland Colantha 8th	Piri Land Company, Auckland	4 333	346·8	365	21,465·7	755·24
Rosevale Burkeyje Sylvia	H. North and Sons, Omimi	4 287	342·2	365	17,834·8	703·82
Colinton Betty	R. Colee, Greendale ..	4 318	345·3	365	14,495·4	477·57
Mature.						
Hilda Minto de Kol ..	C. H. Steadman, Kamo	12 56	350·0	365	27,773·8	1046·31
Rosevale Sylvia Keyes	H. North and Sons, Omimi	5 11	350·0	365	25,344·0	777·23
Lakeview Lotta ..	H. R. Green, Kairanga	6 330	350·0	312	18,966·7	588·32
Waituki Princess Viola Burke	T. C. Barbour, East Tamaki	5 254	350·0	365	14,613·8	567·00
Nancy Lee 2nd ..	Frank Ducker, Opotiki	9 282	350·0	334	12,085·4	406·88
	MILKING SHORTHORNS.					
Junior Two-year-old.						
Pine Farm Daisy 2B	J. Parkinson, Opotiki	2 176	258·1	365	12,584·1	455·33
Mature.						
Ingleburn Duchess ..	J. Pease, Matatoki ..	10 64	350·0	365	12,640·0	472·83
	AYRSHIRE.					
Two-year-old.						
Maesgwyn Moonlight	C. Morgan Williams, Ohoka	2 162	256·7	365	8,692·3	336·23

Second-class Certificates.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Days.	Milk.	Fat.
	JERSEY.					
Mature.						
Geraldine	C. Stevens, Maungatapere	6 189	350·0	365	8,601·6	520·32
	FRIESIAN.					
Junior Two-year-old.						
Bainfield Topsy 10th	W. D. Hunt, Invercargill	1 356	240·5	365	15,162·5	567·88

CARROTS FOR SHEEP-FEEDING.

In the *Journal* for November, 1917 (page 277), the writer referred to carrots as a field-crop for sheep-feeding. Since then, owing to the increasing difficulty of growing swedes free of disease, carrot-growing for sheep has considerably extended in the Wanganui–Taranaki coastal areas. On a farm near Waverley this year 7 acres of a 13-acre field carried 800 breeding-ewes for six weeks, and did them well. Several field-crops have been weighed and have given yields of from 36 to 45 tons per acre. The Guerande carrot mentioned in the previous note is still considered the best for sheep-feeding.

Several methods of growing have been tested, but the one which appears to give the best results is sowing on ridges 21 in. to 26 in. apart, with seed at the rate of 1 lb. per acre. Thinning is not necessary, but the carrots should be intercultivated a few times by means of the horse-hoe to keep the land free and control weeds. With drills anywhere between 21 in. and 26 in. apart the cultivation is easy. Thinning has been tried, but so long as weeds are controlled it is not considered advisable. These carrots may also be sown on the flat through every coulter of the drill, seeding at the rate of 2 lb. per acre. The ridge method is the best, however, the crop being easier to clean and feed off.

Farmers who find it difficult to grow swedes and have suitable land for carrots are confidently recommended to give the latter a trial. They should be sown from the middle of November to early December.

—*J. W. Deem, Fields Instructor.*

PROTECTION OF NATURAL ENEMY OF THE RABBIT.

By an Order in Council under section 25 of the Rabbit Nuisance Act, 1908, dated 20th August, stoats and weasels are declared to be natural enemies of the rabbit, and the killing or capturing of such animals is prohibited without a special permit signed by an Inspector.

In regard to this Order, it is notified for public information that—(1) In districts which are free from rabbits consideration will be given to the granting of an exemption from the general protection upon receipt of a petition in that behalf made by any local authority or acclimatization society in accordance with the provisions of section 25 of the Rabbit Nuisance Act, 1908; (2) Inspectors of Stock have been authorized to issue permits for the destruction of stoats and weasels on (*a*) island sanctuaries; (*b*) acclimatization societies' game-rearing farms; and (*c*) poultry-farms where it is established that damage is being done on such farms by these animals.

IMPORTATION OF ANIMALS INTO AUSTRALIA.

The several Commonwealth Proclamations governing the importation of animals into Australia have been modified and consolidated as from July last. Importation from New Zealand is permitted of horses, mules, asses, cattle, sheep, swine, goats, dogs, and cats, subject to the general provision requiring certificates and declarations to be furnished in accordance with the quarantine regulations.

SEASONAL NOTES.

THE FARM.

PASTURES.

PASTURES will now be making good growth, and every care should be taken to feed them as evenly as possible so as to prevent their getting away. There is nothing like a well-grazed clean pasture to produce butterfat or fatten stock. If droppings have been allowed to accumulate the tripod or chain harrows should be used to scatter them. On farms devoted partly to dairying and partly to the pasturage of sheep, paddocks on which ewes are to be turned with their lambs should be heavily stocked with cattle during October, in order to prevent too rank a growth of grass in November and December, as, if this occurs, scouring will result in the ewes, and the number of lambs fattened off their mothers will consequently be reduced.

Paddocks intended for hay should be shut up about the middle of October. Where possible the haying of permanent pastures should be avoided. It is preferable to hay short-rotation pastures consisting of perennial rye- and cow-grass where such pastures exist. Owing to the saturated state of the subsoil this year such grass-sowings may be confidently made in October.

When sowing down pastures in general at this season of the year it is good practice to drill either 1 lb. of rape or Buda kale, then roll the land again and sow the grass-seed, covering the latter with light tine or brush harrows. The rape or kale supplies some quick feed and shelters the young grass.

SUMMER FORAGE CROPS.

Land intended for mangolds, carrots, soft turnips, kale, cereals and vetches, &c., should be well worked in preparation for sowing towards the end of October or early in November. Generally speaking, the first week in November is early enough, but in the warmer situations these crops may be sown any time after the middle of October. On farms where club-root and dry-rot have been bad during the preceding season an endeavour should be made to arrange for sowing brassicas on land which has not been under that class of crop for a number of years.

Good varieties of soft turnips are Red Paragon, Lincolnshire Red Globe, Hardy Green Globe, and Imperial Green Globe. Where they are required for feeding to cows it is best to sow a small area first, and more in about two or three weeks. On a properly prepared seed-bed 8 oz. to 10 oz. of seed per acre is ample. Suitable manures are basic super, or mixtures of two parts of super and one of Ephos phosphate, basic slag, or Nauru rock phosphate, at from 2 cwt. to 3 cwt. per acre. Sow through every second coulter of the drill or on ridges. For early crops of turnips it is worth while to steep the seed in turpentine before sowing, with a view to preventing the attack of the fly or beetle.

If rape is cropped after grass on good land 3 cwt. of super and Nauru rock (half-and-half) gives good results. On poorer land, or where the rape follows a cereal crop, one of the freezing-works mixtures containing 2 to 3 per cent. of insoluble nitrogen is probably preferable. Rape has a heating effect on lambs, and the headland and a few strips across the paddock should be sown in mustard just after the rape is up in two rough leaves, so that the two crops mature at the same time.

MANGOLDS AND THEIR CULTIVATION.

Provided they have a chance to become well rooted before dry summer weather arrives, mangolds often do quite well in dry seasons when the swede crop is a failure. Prizewinner, Jersey Queen, White Sugar, and Red Intermediate

are among the best varieties. Where a fair area is being put down it is advisable to sow two or more varieties so that the stock will have a change; there are also slight variations in the ripening-period.

For small areas mangolds may be sown in drills 14 in. to 21 in. apart and hand-hoed, but for anything over ½ acre the drills should be from 22 in. to 28 in. apart, so as to permit the intercultivation being done by means of the horse-hoe. Mangolds require a good free soil, and may either be drilled on the flat or put in with the ridger. The latter method allows a better distribution of manure, and the crop is easier to clean. The seeding should be at from 4 lb. to 6 lb. per acre.

Manuring should be generous, not less than 3 cwt., but generally from 4 cwt. to 6 cwt. will be found profitable. Mangolds like a complete manure, and for this reason special mangold-manures are very suitable—mixtures of half super and half Ephos, bonemeal, or Nauru; or three parts super and two parts bone, Ephos, or Nauru. Sulphate of potash, at ½ cwt. per acre, added to these is an advantage. Salt is also very beneficial, especially in situations a fair distance from the sea. This should be broadcasted at the rate of 3 cwt. per acre, and harrowed a day or two before the crop is sown. In place of the sulphate of potash and salt, kainit may be used at from 2 cwt. to 3 cwt. per acre; it supplies both salt and potash.

CARROTS.

Carrots make a valuable forage crop for milking-cows in the late autumn and early winter; while for hard-fed horses a few each day when the grass is scarce are an excellent dietetic. Their suitability for sheep-feeding is dealt with in a special note elsewhere in this issue. The crop does best in a deep, sandy loam, with a free subsoil. Matchless White, Sinclair Champion, and White Belgian are good varieties for field purposes, being heavy yielders and easily lifted.

Where the area grown is not large the seed may be sown in drills 14 in. apart, and the rows hand-cultivated; this system generally gives the heaviest crop per acre. On the other hand, if the area is fairly large the sowing should be in drills 21 in. to 28 in. apart, with subsequent horse-cultivation. If properly worked, nearly as heavy a crop can be grown this way, and the labour is greatly reduced. For the wider drills sow at the rate of 1 lb. per acre, and for the 14 in. rows 1½ lb.

Where great difficulty is experienced in growing swedes, owing to club-root and dry-rot, carrots should certainly be given a trial.

MAIZE-GROWING.

In districts where maize is grown for cob-production preparation of the land should now be well in hand. Maize is expected to make abundant growth during a comparatively short period, and the initial cultivation should be both deep and thorough. Under suitable climatic conditions the crop will thrive on a wide range of soils, but land that is cold or badly drained should never be selected.

Seed should have been chosen last autumn from the standing crop just before harvest, and careful selection is amply repaid by the increased yield resulting. About sixteen average cobs, or 15 lb. to 20 lb. of seed, are sufficient to sow an acre, the plants being about 10 in. apart in 3 ft. 6 in. rows. This will give the crop sun and air—all-important factors. October and November are generally the favoured months for planting. The seed should be set about 1½ in. deep, and manure used according to the fertility of the land. Generally speaking, 1½ cwt. to 3 cwt. of a mixture of super and blood-and-bone will give profitable results.

Thorough cultivation during the growing season is of prime importance, in order that weeds may be kept down and a good soil-mulch maintained, thus ensuring the steady growth of the crop. Constant use of the horse-hoe will be well repaid, however clean the land may appear to be.

CEREALS.

The fine weather experienced this month (September) has enabled farmers to sow wheat where spring sowing can safely be practised. Oats should not be sown later than October, and barley-sowing should also be completed then. Autumn-sown wheat should now be rolled and harrowed.

Barley, being a surface feeder, naturally prefers a light soil of a sandy and calcareous nature. Although it does best after a root crop, it can be grown anywhere in the rotation, and should receive the same cultivation as that given to the oat crop. As maltsters desire a fairly large uniform quantity of grain with even germinating-capacity, it is desirable that the growers in each district should endeavour to crop the same variety. In Marlborough varieties of malting barley of the Chevalier type are most commonly sown in October on the heavier lands—those of the Wairau Plain. The Gisborne variety is usually autumn-sown in the drier country of the Awatere Valley. In the Hawea and other inland districts of Otago where barley-growing plays an important part in the farm operations it may be sown right up till the end of October. A variety named New Binder has given excellent results and is well worthy of extended trial.

POTATOES.

From the beginning of October onward the second early and main crop of potatoes may be planted, care being taken that the ground is sufficiently worked to be free from weeds. From 10 cwt. to 15 cwt. of seed should be sown in 28 in. rows to allow of intercultivation with horse-drawn implements. Good moulding-up tends to prevent the ravages of potato-blight and to ensure heavier crops. A manurial mixture consisting of 3 cwt. super, ½ cwt. sulphate of potash, and ¼ cwt. sulphate of ammonia generally gives good results.

Only the best of seed should be used. Many selections of the chief varieties of main croppers go under various names. Among the good standard varieties are Up-to-date, El Dorado, Arran Chief, King Edward, Maori Chief, Gamekeeper, and Northern Star. The last three varieties are more or less immune from blight.

In favourable situations and circumstances a few acres of potatoes make a very valuable cash crop on a small dairy farm, and help materially to increase the net returns. For domestic use it is a good plan to plant a few drills of potatoes in the mangold-field, as the two crops are sown and mature about the same time.

PULSE CROPS.

Peas should be sown during October. In Canterbury there were indications during last season that the regulation seeding of one sack to the acre was too heavy. Cases of lighter seedings which resulted in good yields have been brought to notice. In Marlborough, Dwarf, Medium Straw, Partridge, Prussian Blue, and other varieties should be sown not later than the second week of the month. About 3 bushels per acre of the Dwarf and Medium Straw varieties, and 2½ bushels of Partridge and Prussian Blue (smaller peas), are sown. Owing to collar-rot, pea land in Marlborough should generally be limed; superphosphate should not be used alone.

LINSEED.

Land should be prepared for this crop where grown, and it may be sown towards the end of October at the rate of 30 lb. to 35 lb. per acre.

LUCERNE.

Most lucerne stands will now be shut up for a crop. Where necessary the stand may still be top-dressed with superphosphate at the rate of 2 cwt. per acre. In Marlborough, owing to fine weather conditions, it is sometimes possible to get a cut of lucerne hay in October. This, however, is not possible in most districts. Ensilage may be made, or the lucerne cut and fed out in a neighbouring paddock. In this way much of the nutrient matter is returned to the ground in the droppings from the stock.

Under Canterbury conditions, where late frosts are a frequent occurrence, sowings of lucerne should not be made before the end of October, except in cases where the soil is extremely light and the crop is likely to be damaged by the hot drying winds sometimes experienced in early summer. The sowing season may be extended until the beginning of March. It should be remembered, however, that October seeding is advisable only where the land is thoroughly clean and where there is no risk of weeds getting away with the young crop. Spring sowing certainly has the advantage of enabling the young plants to escape grass-grub attack.

—*Fields Division.*

SANITARY PRECAUTIONS AT SHEARING-TIME.

Blood-poisoning among sheep at shearing-time is still too prevalent, and calls for the close attention of farmers. After a thorough clearing-out of the shed the first consideration is absolute cleanliness of the shearing-board and counting-out pens. The floor and walls should be thoroughly scrubbed with a disinfectant before and immediately after shearing. The counting-out pens should be swept clean and liberally sprayed with disinfectant, and afterwards a small quantity of unslaked lime spread on the pens.

The shearers' water-pots for cooling shears or machines are a likely source of infection. They should be cleansed with disinfectant, and when refilled with water a small quantity of kerosene should be added. The reason for this is that the kerosene floats on the surface, so that every time the shears are withdrawn a coating of kerosene adheres to the shears and acts as a very good disinfectant.

Much the most common cause of blood-poisoning is the entrance of germs through small wounds—wounds which are very often unnoticed by the shearer. As soon as these small wounds are covered over with scurf or matted wool the germs of blood-poisoning immediately become active. A sharp lookout should be kept, and, no matter how small the wound, each should be dressed with Stockholm or Archangel tar, which should be kept handy in a receptacle for the purpose. All excreta are hotbeds of bacteria, especially from such animals as pigs, fowls, or dogs, and the quartering of such animals in or near a shearing-shed should be carefully avoided. The excreta when dry are blown about by wind, and often deposited in the counting-out pens and even on to the shearing-board, or on to the fresh wounds while the sheep are held for counting and branding.

—*F. Mackenzie, Live-stock Division.*

THE ORCHARD.

SEASONAL SPRAYING.

DURING this season of the year the new growth of trees is at the tenderest stage of development, which condition, combined with the moist to humid weather generally prevailing, renders the trees very susceptible to the various fungus diseases which become active at the same period. The hope of success with the coming season's crop depends in a great measure on the precautions taken to guard the developing growth from attack not only by fungus diseases, but also by the insect pests which abound at this season of the year.

The tender state of the trees necessitates the exercising of great care in the use of sprays in order to avoid damage to the foliage and promising crop, but, on the other hand, the prompt use of a suitable spray is the best safeguard against attack or infection. Under no reasonable circumstances should such a spray be neglected, as it becomes almost impossible to later regain the control over diseases which have become established

Peaches, nectarines, and Japanese plums should be sprayed with lime-sulphur, 1–125, plus 6 lb. atomic sulphur. The addition of atomic sulphur to the usual lime-sulphur spray is well worth while, as wherever tried it has increased efficiency in the control of brown-rot. Black aphis may be expected on this class of trees, and should it appear Black Leaf 40, 1–800, may be added to the above spray. Where there are a few isolated bad colonies it is wise to cut out the infected parts as an additional precaution. English plums are somewhat later in showing growth. Bordeaux mixture, 6–4–50, should be used at the tight-cluster stage as a special precaution against rust. Too often these trees are missed with the spring bordeaux, as they are somewhat out of time with the other stone-fruits.

Seasonable spraying for pears will be bordeaux, 6–4–50, at tight-cluster, followed by a further application at 3–4–40 at pink-cluster, as late as possible before the bloom opens. In districts where black-spot is not prevalent, or on varieties not prone to this disease, lime-sulphur, 1–25 and 1–80, may be substituted at the same periods.

As the price received for good quinces is, in the main, more remunerative than that for mid-season apples and pears, it is difficult to understand the general

lack of attention to these trees. Many at present semi-neglected trees could, with a little extra care, be made much more profitable. Spraying as for pears will materially assist towards this end.

For apples the tight-cluster spray of bordeaux, 6–4–50, is the foundation spray against black-spot. A further spray is then necessary about open or pink cluster. This should be lime-sulphur, 1–80, on varieties least susceptible to spot, and bordeaux, 3–4–40, on others. It is at this stage that the greater part of the russet is caused; therefore bordeaux should not be used except where spot is anticipated. A word of warning is also necessary in regard to the use of lime-sulphur at this stage, as when it is applied on Delicious, Lord Suffield, and Ribston Pippin there is a tendency for these varieties to shed the fruit.

When the petals have fallen (calyx stage), apples and pears should be sprayed with arsenate of lead, 2 lb., plus lime-sulphur, 1 gallon to 100 gallons of water to which the milk of 2 lb. freshly slaked lime has been added. While some orchardists argue that this calyx spray is not necessary for the control of codlin-moth, its application should not be omitted, as there are various other biting and chewing insects to be considered, and if these are controlled at this stage better fruit results.

ELIMINATING LOW-GRADE FRUIT.

There can be no two opinions about the detrimental effect low-grade fruit has on the markets, and the desirability of keeping the latter as free as possible of this class of produce. There is a variety of opinion as to how this may best be accomplished, but the surest method is to eliminate the production of such fruit.

After the experience of the past season it behoves every orchardist to make a special effort to reduce to a minimum the production of "culls." This is the season of the year when the majority of the culls are made—bad weather conditions or faulty spraying allowing black-spot and other diseases to get hold; wrong mixture or wrong time of application causing russet; neglect of insecticide permitting insects to injure the fruit and cause blemish; lack of attention to thinning resulting in deformed and undersized fruit; overcropping causing malnutrition; and lack of cultivation inducing shortage of summer moisture. The foundation of at least three-quarters of the faults in cull fruit is laid at this season, which is the most opportune time for checking the factors causing defects in the crop.

CULTIVATION, GRAFTING, AND THINNING.

Where spring ploughing has been delayed the work should be undertaken at once, and the land so turned over worked down with as little delay as possible. Continue the cultivation of ploughed land and endeavour to secure a good tilth.

Grafting may be done as the sap rises and the bark moves freely on the stocks to be worked over.

Some of the earlier varieties of peaches will have attained a fair size by the end of the month, and a start may be made to reduce the number of fruits carried. This work should be undertaken very cautiously until the fruit has proved fertile by the development of the pit. As a preliminary to thinning of pip-fruits the flowers should be pinched or cut away from the tops of the leader growth. All the bloom should be removed from one-year-old wood in any case, and may with advantage be removed from two-year-old wood on leaders of trees which are weak in habit or health.

—*W. H. Rice, Orchard Instructor, Hastings.*

CITRUS FRUITS.

In cases where spring work in the citrus orchard has not yet been undertaken this should be immediately put in hand. Manuring, digging, and ploughing should be carried out at the earliest possible date, followed by early spraying with bordeaux, 4–4–40, when the majority of the blossom-petals have fallen after the main flowering. In regard to manuring, an application of two parts of blood-and-bone to one part of super is recommended. The addition of a small percentage of potash will also be found beneficial in most instances.

FIREBLIGHT.

It is noticed that there is a considerable lack of interest taken by some growers in regard to the proper disposal of prunings taken from pip-fruit trees.

While the menace of fireblight is still on hand. no risk should be taken in this regard; all prunings should be carefully collected and destroyed by burning, in preference to the practice adopted by many orchardists of placing the prunings in or under the shelter-belts adjacent to the orchard. This is always dangerous, from many points of view, and should be avoided.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CARE OF THE YOUNG STOCK.

It may be reiterated that if only profitable stock are to be reared all chickens should be hatched out during the next two weeks at the latest. Chickens brought out later will never return even a fair profit over their keep. Present indications are that foodstuffs, particularly wheat and its by-products, will reach a high level of value by the time this season's stock reach a productive stage. This, together with the fact that the average price of eggs has been gradually declining, is sufficient to indicate that the present aim of poultry-keepers should be to secure quality of stock rather than numbers alone. It should never be forgotten that a better return will always be secured from a small flock of early-hatched birds than from a large number late-hatched.

Not only must the chickens be hatched early, but in addition they should be given every opportunity to make healthy development. This implies liberal feeding from first to last. Plenty of good grain is necessary, but an ample supply of succulent green stuff is of equal importance; indeed, young stock will never thrive to the best advantage unless this is provided with a free hand.

Before the chickens are removed from the brooder every care should be taken to make the houses fit to receive the young birds. Where the quarters intended for the chickens have recently been occupied by adult stock they should be thoroughly cleaned and sprayed with a good disinfectant, as there are few houses that are quite free from vermin. Do not allow the chickens to huddle in the corners of the house when first removed from the brooder, or the mortality may be great. The corners should be rounded off with fine-mesh wire netting. In addition, a temporary hover made of sacking or similar material should be provided for the chickens to sleep under. This will give them the seclusion which they naturally look for after leaving a closed-in brooder; but at the same time it must be arranged in such a way that the birds can secure an ample supply of fresh air.

The chickens should not be allowed to sleep on a hard floor, as this is apt to cause crooked breast-bones; the floor should be well bedded down with perfectly dry straw. Grass hay should never be used for this purpose, as it is apt to heat and bring on a sweated condition of the chickens, with serious results. The chief trouble caused in this way is an inflammation of the veins. It first makes its appearance in the hock-joints, which become discoloured; then a gangrenous swelling follows; in a few days the wings become affected in a similar manner, and later the neck and head swell. At this stage death is not far off. There is no cure for this trouble; it is merely a question of prevention. Do not over-crowd; provide ample ventilation; keep the floors clean and dry; and check everything that tends to create a moist atmosphere. Wherever possible a piece of fresh ground should be provided for the growing stock. This is one of the secrets for their sound development.

Do not allow chicks of different ages to run together. Some people even go so far as to allow the young birds to run with the adult stock. This is a serious mistake. It is useless taking every care of the chicks during the brooder stage and then placing them at such a disadvantage. Few old birds are quite free from vermin. Incubator chicks, if given careful management, should go right on to maturity without having to fight parasitic life; but exposing them to probable vermin infection by forcing them to run with old stock and on stale ground is obviously all against their attaining desired size and sound constitutional vigour. No care and attention is too good for the growing birds.

GIZZARD TROUBLE IN WHITE LEGHORNS: A WARNING.

Whether or not the flocks of many poultry-keepers are on the down-grade so far as constitutional vigour and digestive power are concerned is difficult to say. The fact remains, however, that in too many cases flocks of the popular White Leghorn breed are becoming more weedy than ever before. Although actual disease is not on the increase (except perhaps in the case of tuberculosis), there are other troubles which have increased to a somewhat alarming extent in recent years. For example, scarcely a day passes but cases are reported of birds dropping dead at feeding-time from no apparent cause—birds which in most cases are in a heavily productive condition. It is safe to say that for every complaint received a few years ago regarding this trouble there are a hundred now.

The writer has made many post-mortem examinations in investigating this mortality. In almost every case the heart was found to be in a badly ruptured condition, and the gizzard packed with fibrous material, such as pieces of grass, oat-husks, &c. Obviously, the ruptured heart was the sole cause of death, but here the question arises, What caused the heart to rupture? The writer is of the opinion that this was entirely due to the gizzard being compacted with fibrous material, causing derangement of the digestive system. The excitement at feeding-time caused an excessive blood-pressure, and consequently a ruptured heart. A further question which presents itself for consideration is, What causes gizzard-compaction? It may be said that this is due to lack of proper grit, but this opinion is discounted by the fact that in many cases post-mortem examinations have disclosed that the gizzards contain plenty of grit. In some affected flocks it was observed that when all fibrous matter, such as oats, were eliminated from the ration the mortality ceased. Here another question presents itself for consideration. In view of the fact that many breeders daily feed their birds on oats with no injurious results, it appears that when mortality takes place from this trouble, as previously outlined, its chief cause is a constitutional weakness and lack of digestive power, probably brought about by sacrificing everything for egg-yield.

Once this trouble makes its appearance in a flock the only safe course is to withhold from the ration as far as possible any fibrous material such as oats, grass, lucerne, &c. Finely chaffed succulent green stuff should be provided in abundance. If this is not available, root crops such as turnips, mangolds, &c., should be provided for the birds to pick at. In addition, see that plenty of sharp gravel grit is within reach at all times. In this way the birds are given an opportunity to free themselves from any fibrous matter that may be contained in the gizzard. This, however, is merely a temporary expedient.

If the stock are to be permanently free from this and other troubles which affect poultry, breeders must realize, and at once, that if everything is sacrificed for egg-production disaster must follow. The danger of improving one character by weakening another should always be kept in mind, and while aiming for high egg-records care should be taken that constitutional vigour—the foundation of all successful breeding operations—is not lost in the process. The warning is here, and breeders should heed the lesson that egg-record is not everything in the maintenance of payable flocks. However well a fowl may lay, if she does not possess the desired constitutional points she should not be bred from. Strange to say, the writer has not had one complaint regarding the trouble in other than the White Leghorn breed.

SOFT-SHELLED EGGS.

Now that the birds are laying at the height of their capacity, soft-shelled or shell-less eggs are apt to be produced. These not only mean a direct loss, but they also encourage the birds to acquire the habit of egg-eating. Such eggs are easily broken, and once the hens have tasted the substance it will probably not be long before they learn to break the shells of the sound eggs for themselves. Soft-shelled or shell-less eggs are mostly caused through lack of shell-forming material, or through the birds being overforced with rich food such as meat, meat-meal, condiments, &c., while sometimes the trouble is due to the fowls being overfat and their reproductive organs not functioning normally.

A liberal supply of crushed oyster-shell or burnt bone, together with ample provision for the birds to exercise, will help to correct matters in this respect. As to condiments, these should never be fed to a laying flock. They may stimulate the egg-producing organs, but as a general rule the effect is brief, and the reaction

which sets in not only defeats the end in view but also tends to cause ovarian troubles, possibly resulting in a complete breakdown and subsequent death. The best testimony we have of the futility of condiments for consistently stimulating egg-production is that the high records obtained at the egg-laying competitions are established without their aid.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

SEASONAL PREPARATIONS.

OCTOBER is perhaps the month when the apiarist can do most in helping his bees to work up to full strength in time for the main honey-flow. In the warmer parts of the country swarms may be looked for about the middle of the month, but in the southern districts they will probably not appear until three or four weeks later. By 1st October, unless the weather for some weeks has been cold and wet, every hive should have been examined and its condition noted with regard to stores, population, and health.

No colony should be allowed to dwindle because it has not sufficient food to provide for the offspring of a prolific queen. Yet, on the other hand, some beekeepers prefer that all the old honey in the hive should be used up before the new season's flow commences. The food-supply of the hive is sometimes an exceedingly puzzling matter, as it varies considerably in accordance with the weather and the strength of the colony, and only periodical and systematic examinations can settle the question as to whether all is well with the hives in this respect. No harm can be done by feeding good white-sugar syrup, but a hive which is starved in the spring will probably not recover its strength till the main honey-flow is nearly over. By the middle of October, under normal weather conditions, every hive should have at least four frames of sealed brood, and many will have more. Those that have fewer, unless their food-supply is very short, should be marked for requeening as soon as possible. The apiarist's endeavour should be to keep his colonies as even as possible, thereby obtaining a uniform surplus throughout the apiary.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the month to treat any cases of disease which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost suicidal for the beekeeper to treat his bees in October; in others, where right conditions prevail, it may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding.

HIVING SWARMS.

In most text-books on beekeeping this kind of advice is given: "When a swarm settles into a cluster take a light box and shake the bees into it," &c. This advice is all right where the bees are accommodating enough to settle into a convenient position for the shaking process to be carried out. Unfortunately, in many cases bees get into positions whence it is impossible to dislodge them so easily. Sometimes they will settle on a small bush, and much of the cluster will be on the ground. In this case probably the best thing to do is to place the box over the cluster, and if the bees do not show much disposition to climb up into the box they may be persuaded to do so by the use of a little smoke. When they cluster in the centre of a prickly hedge the box should be placed on one side of the hedge, and the beekeeper should puff smoke from the other side of the hedge, and thereby drive the bees towards the box. In the event of the swarm taking possession of a fencing-post and clustering on it from top to bottom, as they occasionally do, the smoker must again be used, and in addition it is as well to brush the bees from each side of the post in turn into the swarm-box with the brush which is used for the frames at extracting-time.

The usual practice is to leave the box sheltered from the sun and covered with a sack near the place where the swarm has settled. Where few hives are kept this may be done with impunity, but if other swarms are expected it is well to remove the box to the place where the colony is to stand permanently, otherwise before the close of the day the probabilities are very largely in favour of the box being taken possession of by three or four other swarms—a matter of annoyance to the man who wishes to keep his swarms separate.

In every case a swarm should be attended to as soon as it settles. Many people are under the impression that swarms should be left undisturbed till nightfall, but this idea is an erroneous one. They should invariably be placed in the box as soon as possible after the cluster is formed, and put so that they are sheltered from the rays of the sun.

WATER-SUPPLY.

One of the most important of the minor details of apiculture is the provision of a constant water-supply for the purpose of assisting the bees in brood-rearing. Not only is it necessary to conserve the energy of the bees by having the water close at hand, but it is well to ensure that they do not prove a nuisance at taps, cattle-troughs, &c. From early spring till late autumn water is an absolute necessity to bees, and they will consume comparatively immense quantities in fine weather. It thus behoves the beekeeper to see that a liberal supply is always available. By establishing his drinking-fountain early in the season he will teach the bees where to go for supplies, and ensure their always seeking the same spot for water.

—*E. A. Earp, Senior Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

In former notes it has been suggested that broccoli may very well be omitted in the warmest districts, cauliflowers being grown to take their place. The diamond-backed moth makes it difficult to grow broccoli in such places, as they must be planted when the moths are in full force. In other districts broccoli cannot be dispensed with. The moth is likely to cause some trouble in any locality, but the risk must be taken. In any case it will not be so serious a trouble as in warmer districts, mostly disappearing when autumn rains set in. The writer has been successful in preventing damage by the moth by giving the plants an early start, so as to secure good-sized plants before the moths become numerous—usually some little way into the New Year. With this object in view all the varieties to be grown should be sown at the same time—about the last week in October. The plants should be given every chance to make quick growth, and should be planted as soon as they are large enough. Good cultivation should be afforded, and a little nitrate of soda given to help them along. The plants should then be strong before the moths are troublesome, and if the latter do some damage to the outer leaves it will not matter if the growing centre is protected. This can be done by dropping a little hellebore powder on the heart of each plant. The hellebore will remain in position a long time. Rain will dissolve some of it and wash it farther in, but it takes a lot of rain to wash it out. Two or three applications at most will see the plants safely through. Early, mid-season, and late varieties should be grown, and though started together they will mature in the proper sequence.

Cauliflower of a giant kind should now be sown to give heads for use in autumn before broccoli come in. Brussels sprouts also should be sown, a long season of growth being necessary to obtain good crops.

French beans may be sown in all localities early in October, or somewhat earlier in extra-warm and frost-free places, where butter-beans may also be sown. For the cooler districts Canadian Wonder or varieties of the same type are best. Where broad beans were sown in June, or near that time, another sowing may be made in October, these two sowings being sufficient for the season. Runner beans should be sown early in October. To maintain a constant succession peas should be sown twice every month.

Lettuces should from now on be sown thinly in lines, the surplus seedlings being pulled out and plants for the crop left standing. Seeds for the main crop of leeks should be sown during the last half of September. Sow in lines and transplant when 8 in. or 9 in. high. In the colder districts winter crops of parsnips, carrots, and red beet should be sown in October, in middle districts during the first week in November, and two or three weeks later in the warmer parts. Turnips should be sown in small lots during the summer season, sowing a fresh lot about every seven weeks.

Increasing supplies of winter rhubarb on the market during the past winter show that the culture of this variety is extending. There is no doubt it can be made a profitable crop in all but the coldest districts. New beds may be formed by sowing seeds about the month of October, or by divisions of old stools. It is advisable to divide the old stools when they get too large, as the sticks are otherwise liable to come too small. A good time to lift the old stools is when the first crop of the summer variety comes into use. The stools should be cut up into pieces carrying one or two good crowns. All large leaves should be cut off, leaving only newly sprouting young leafstalks. Transplanting should be done at once on fresh ground previously prepared.

Success with onions largely depends on the attention given in the early stages. Timely thinning and thorough cultivation are important factors. A dressing of nitrate of soda, allowing about ¾ oz. per square yard (approximately 2 cwt. per acre), will have a marked effect on growth. The nitrate can be easily applied if mixed with dry wood-ashes.

Tomatoes.

In the warmest districts planting-out will have been already done, but in most places planting is not done till the end of October or early in November. The soil should be prepared a few weeks before planting. Where green crops are to be ploughed in, the green matter should be allowed time to get through the first stages of decay before planting is done. It is now a well-ascertained fact that the black-stripe disease, which has caused many losses, is mainly due to the excessive use of nitrogenous manures and fertilizers, including stable dung. The use of stable dung should be avoided. Suitable fertilizers are superphosphate, sulphate of potash, and sulphate of ammonia, allowing 3 oz. of the former and ¼ oz. of each of the others for each plant.

SMALL-FRUITS.

Raspberries: The disease known as raspberry anthracnose (*Gloeosporum venetum*) is fairly prevalent, and has caused the loss of crops. Correspondents have informed us that they have saved their crops by applying the remedies advised, where previously the crops were a total loss. The remedy is to spray with 4–4–40 bordeaux mixture when the young leaves begin to unfold, and again about a week before the blossoms begin to open. When the crop has been gathered the old canes should be cut out and the young canes sprayed as before. As an alternative spray lime-sulphur can be used, 1 in 10 for the first and 1 in 40 for subsequent applications. Bordeaux should have preference, as it has been proved to be effective. The disease first attacks the base of young canes, showing as purplish blotches on the canes. It gradually works its way up the cane. The blotches later assume a greyish colour, with a purple rim around them. It is in the second or fruit-bearing year that the damage is done. If the disease has been able to run its natural course it then attacks the fruit-bearing laterals and leaves thereon, and causes the fruit to shrivel up.

Gooseberries: If mildew is present, or the bushes are affected with leaf-spot, spray with 4–4–40 bordeaux as soon as the fruit is set.

—*W. H. Taylor, Horticulturist.*

New Zealand Meat-producers Board.—The electoral committee of the Board met at Wellington on 29th August. The three retiring producers' representatives —Messrs. J. C. N. Grigg, J. S. Jessep, and W. Perry—reoffered their services, and were unanimously elected. The committee also adopted the annual report and balance-sheet of the Board.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HYDATID CYSTS IN CATTLE.

"SUBSCRIBER," Gisborne:—

Could you give me any information on hydatids in cattle, more especially as to what effect they would have on the milk of a cow?

The Live-stock Division:—

Hydatid cysts are the cystic stage of a tape-worm (*Taenia echinococcus*) of the dog, and are commonly found in the lungs, liver, and abdominal cavity of cattle, but may occur in almost any organ or tissue. The cyst takes six months to develop, and ranges in size from a pea to a duck-egg, or even larger. A liver or lung thus affected is more or less enlarged according to the size or number of cysts present. Symptoms vary in proportion to the seriousness of the infection. Where the lungs are badly infected there is marked alteration in the breathing; and in the case of the liver, digestion is disturbed and emaciation becomes marked. Diarrhœa is not uncommon. It is only in these cases that any marked alteration is noted in the quantity and quality of the milk, and though there would be no danger of hydatid infection from drinking it, this would be inadvisable, owing to the general ill health of the animal.

GRASS-MIXTURE FOR HILL-SLIPS.

G. H. WILLIAMS, Rakauroa:—

Will you please advise me as to the best grass to sow on hill-slips? They are of a sand-and-pumice nature, and soon dry up. Also, I notice you recommend the inclusion of danthonia in some of the mixtures given in the *Journal* for May last; as I believe there are various danthonias, which variety would you recommend as the best?

The Fields Division:—

If the land is not likely to be ploughed the following mixture is advised: Perennial rye-grass, 8 lb.; Waipu brown-top, 2 lb.; Chewings fescue, 4 lb.; Danthonia pilosa, 2 lb.; white clover, 1 lb.; suckling clover and Lotus major, ½ lb. each; Yorkshire fog, 3 lb. Sow at the rate of 25 lb. per acre. There are several varieties of danthonia; the pilosa variety should be used.

ABORTION AMONG EWES.

E. R. B., Swannanoa:—

I should be pleased if you would inform me the cause of a large percentage of my ewes in a flock of sixty slipping their lambs three weeks before due date of lambing. The ewes have had the run of a mixed-grass paddock, with as much oat-sheaf chaff as they could eat, and an occasional load of mangolds (pitted three or four weeks before using). In May last the ewes suffered from the flood, being a day and night in 20 in. of water, but have kept in good condition all through the winter. Would the abortion be caused by the chill of flood-water, or by eating the mangolds too readily? Believing the abortion to be contagious, I removed each ewe as the trouble commenced. Will the ewes breed again the following year?

The Live-stock Division:—

Contagious abortion in ewes is unknown in New Zealand, but ordinary abortion may be brought about by a variety of conditions, including excessive pressure on the pregnant uterus, such as over-distension of the rumen by

engorgement with chaff, fermentable mangolds, frosted turnips, &c. The use of old rams also may cause the slipping of lambs. The fact that your ewes were standing in 20 in. of water for a day and night would certainly be a contributing cause, owing to the chilling effect on the entire system and the struggling of the ewe. If mated, the ewes will breed again the following year.

CAUSTIC SODA FOR ORCHARD PESTS.

A. WILLIAMS, Wairere Falls :—

Could you let me know if you recommend caustic soda as a fungicide for fruit-trees ? If so, at what strength is it used ?

The Horticulture Division :—

Many years ago, before spraying practice was co-ordinated, caustic soda was used by a good many people to clear the trunks and large branches of fruit-trees from scale insects and moss and lichens. The soda was used with very little dilution and applied with a brush, the operator's hands being protected by leather gloves. Small branches and buds were protected against the scorching effect of the solution by the simple process of leaving them untreated. Later caustic-soda solution was used as a spray at strengths ranging up to 8 lb. to 50 gallons and stronger. This, while excellent for cleaning purposes, was rather severe on the operator as well as the spraying-gear, particularly the valves of the pump. In those early days of fruit-growing very little attention was paid to black-spot and kindred diseases. The fruit was affected or it was not, just as it happened. The great development in fruitgrowing rendered control of diseases and insect pests a necessity. This led to the use of more efficient and less crude methods—spraying-oils, lime-sulphur, &c., for insects, and sulphate of copper and lime-sulphur as the chief fungicides. At the present time, though one does occasionally hear of caustic soda being used, such use is not generally recommended.

"PEAS" IN COW'S TEATS.

KIRK BROS., Mokauiti, Taumarunui :—

Last May we dried off a three-year-old cow and turned her out for the winter quite sound, but with "peas" in all her teats. She has recently calved, and is blind in three quarters, evidently caused by the peas. Can anything be done for her, or to ensure her coming in sound next season ?

The Live-stock Division :—

The complaint described by you is one of frequent occurrence, and is caused by inflammation of the teat-ducts, probably of an infectious nature. The obstructions can be removed or broken down, but the operation is not always successful. In spite of the most careful treatment, inflammation, with destruction of the quarter, frequently follows. On this account the operation is not to be recommended. If the obstruction is not interfered with the milk will gradually disappear from the quarter or quarters, and before the next calving-period, in many cases, it will be found that the obstruction in the teats has also disappeared.

COCKSFOOT FOR SEED-PRODUCTION.

"INTERESTED," Masterton :—

Last April I put down a paddock in cocksfoot for harvesting. Will you please inform me if it is advisable to harvest it next summer, or keep it fed down with stock until the following harvest season ?

The Fields Division :—

It will not be wise to harvest your cocksfoot-paddock this coming season, as the cocksfoot will not be properly established by then. Treat it as a pasture-paddock this summer (but avoiding any heavy stocking), and harvesting operations can then be carried out the following season. Even then the yield will not be great, as it takes a cocksfoot stand some three or four years to come into full bearing.

WEATHER RECORDS: AUGUST, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather during August was changeable, and some very cold nights were experienced, but there was in most parts of the country more sunshine and less rainfall than is usually recorded in August. Three westerly disturbances occurred during the month. Two influenced weather conditions, each over four days, and one, in the middle of the month, accounted for unsettled conditions for about ten days. A strong southerly gale on the evening of the 20th and 21st was caused by an intensification of a disturbance centred in the neighbourhood of the Chatham Islands. Two ex-tropical disturbances passed to the north of New Zealand on the 10th and 24th respectively.

More snow than usual has been experienced during the past winter. There were some falls during August, particularly about the 20th, and the snow came low down the ranges in various places. The snow also has remained longer on the mountains than is customary.

Southerly winds were prevalent—cold and dry most of the time—and rainfalls were generally light.

RAINFALL FOR AUGUST, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	4·44	14	1·02	5·10
Russell	4·41	16	0·86	6·99
Whangarei	5·17	15	1·33	6·93
Auckland	3·19	21	0·50	4·24
Hamilton	2·44	17	0·52	4·15
Kawhia	3·22	13	0·82	4·60
New Plymouth	3·20	13	1·24	5·38
Inglewood	4·90	11	1·20	8·82
Whangamomona	3·75	12	0·93	5·80
Tairua, Thames	4·92	11	1·56	6·98
Tauranga	3·21	14	0·64	4·21
Maraehako Station, Opotiki ..	2·90	12	1·98	4·75
Gisborne	7·07	20	1·73	4·50
Taupo	2·08	9	1·16	4·23
Napier	..	..	..	3·56
Maraekakaho Station, Hastings ..	2·93	14	0·81	3·40
Taihape	2·26	19	0·46	2·67
Masterton	3·62	14	0·98	3·26
Patea	1·62	10	0·46	3·57
Wanganui	1·48	6	0·39	2·78
Foxton	1·56	6	0·72	2·77
Wellington	3·45	15	0·85	4·44
South Island.				
Westport	4·01	15	0·88	6·27
Greymouth	7·20	13	1·81	7·87
Hokitika	6·62	13	1·40	9·38
Arthur's Pass	13·17	12	4·30	13·13
Okuru, Westland	7·66	12	2·40	11·46
Collingwood	5·24	8	1·25	6·96
Nelson	1·95	9	0·66	3·06
Spring Creek, Blenheim.. ..	1·65	7	0·40	2·86
Tophouse	3·79	11	1·28	4·87

RAINFALL FOR AUGUST, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Hanmer Springs	1·92	7	0·50	2·23
Highfield, Waiau	1·42	8	0·40	1·90
Gore Bay	1·28	8	0·71	2·28
Christchurch	1·52	7	0·65	1·75
Timaru	0·48	5	0·18	1·48
Lambrook Station, Fairlie ..	0·74	3	0·64	1·53
Benmore Station, Omarama ..	0·98	8	0·35	1·50
Oamaru	0·54	4	0·24	1·76
Queenstown	3·61	10	0·86	1·80
Clyde	0·54	7	0·18	0·80
Dunedin	1·58	7	0·54	3·17
Gore	..	..	..	2·26
Invercargill	4·12	14	0·70	3·36

AMENDING CATTLE-TICK REGULATIONS.

THE following amending regulations were gazetted on 13th September current, and came into force on the same date. The principal regulations referred to were published in the *Journal* for March, 1922.

1. These regulations shall be read together with and be deemed part of the regulations (hereinafter termed the principal regulations) for the prevention of the spread of ticks (*Ixodidae*) among stock made under the Stock Act, 1908, by Order in Council on the 13th day of February, 1922, and gazetted on the 16th February, 1922.

2. Clause 7 of the principal regulations is hereby revoked, and the following substituted therefor:—

7. (1.) It shall be the duty of every stockowner in Area A to do all that is reasonably possible to keep his stock free from cattle-tick by (*a*) dipping by complete immersion in an effective cattle-tick-destroying solution, which shall contain not less than 7 lb. of arsenious oxide in each 400 gallons of water; or (*b*) treating by some other effective method authorized by the Inspector.

(2.) In any case where a stockowner fails to comply with the requirements of subsection (1) hereof to the satisfaction of the Inspector, that officer may give to such stockowner notice to dip or otherwise treat his stock so as to ensure the destruction of all cattle-ticks upon them, and it shall be the duty of such stockowner to comply with such notice within the time stated therein.

(3.) The provisions of subsections (1) and (2) hereof shall also apply in the case of stockowners in Area B upon whose property ticks have been found to be present.

3. Clause 10 of the principal regulations is hereby revoked.

4. Clause 12 of the principal regulations is hereby amended by the insertion of the figure "1" after the word "subclause" in line four.

5. (1.) Any person desiring to remove sheep from Area A must first obtain a permit from an Inspector, or some other person authorized by an Inspector, authorizing their removal, and such sheep may thereafter leave Area A only at the place and within the time specified in such permit.

(2.) If sheep intended to be removed from Area A are found to be harbouring ticks, a permit shall not be issued unless and until such sheep have been so treated as to ensure the complete destruction of all cattle-ticks upon the legs by immersion in an effective tick-destroying fluid, or by some other effective method at the discretion of the Inspector, or on the head by spraying or sponging with the same fluid; provided that the provisions of this subsection shall not operate where sheep are being removed for immediate slaughter at a duly licensed slaughtering-place.

DAIRY-PRODUCE EXPORT CONTROL ACT, 1923.

THE full text of this measure, as passed in the recent session of Parliament, is as follows :—

1. This Act may be cited as the Dairy-produce Export Control Act, 1923.

Act to be brought into Operation by Proclamation.

2. (1.) This Act shall come into operation on a date to be specified in that behalf by the Governor-General, by Proclamation approved in Executive Council.

(2.) A Proclamation shall not issue under this section unless and until a majority in number of the producers, within the meaning of this Act, have, at a poll to be taken for the purpose as herein provided, voted in favour of a proposal that this Act should be brought into operation.

(3.) At the poll to be taken as aforesaid proposals shall be submitted in the following form :—

1. I vote that the Act be brought into operation.
2. I vote that the Act be NOT brought into operation.

(4.) Every voter at the poll on the proposals submitted under this section shall be entitled to one vote only, and shall record his vote by striking out the proposal for which he does not wish to vote.

(5.) A proposal under this section shall be deemed to be carried if a majority of the valid votes recorded at the poll is in favour thereof, but not otherwise.

(6.) For the purposes of a poll under this section an officer of the Public Service shall be appointed as Returning Officer, and the Returning Officer shall make all necessary arrangements for the conduct of the poll.

(7.) The poll to be taken under this section shall be taken on a day or days to be appointed in that behalf by the Minister of Agriculture, being not later than the first day of November, nineteen hundred and twenty-three, and may be taken by post.

(8.) On the completion of the poll the Returning Officer shall make a declaration as to the result, and shall forward the same to the Minister of Agriculture, who shall cause notice of the same to be published in the *Gazette*.

(9.) The notice published in the *Gazette* shall be conclusive evidence of the result of the poll.

Interpretation.

3. In this Act, unless the context otherwise requires, "dairy-produce" means butter and cheese; "producers" means persons carrying on business as suppliers of milk or cream to factories manufacturing dairy-produce for export.

New Zealand Dairy-produce Control Board.

4. (1.) There is hereby established a Board to be known as the New Zealand Dairy-produce Control Board (hereinafter referred to as the Board).

(2.) The Board shall consist of—(*a.*) Two persons (herein referred to as Government representatives) to be appointed by the Governor-General, on the recommendation of the Minister of Agriculture, as representatives of the New Zealand Government; the Governor-General shall not appoint any person rejected by a vote of the producers as hereinafter provided. (*b.*) Nine persons (herein referred to as producers' representatives) to be appointed by the Governor-General as representatives of producers on election in manner hereinafter provided.

(3.) In addition to the members to be appointed pursuant to the last preceding subsection, the Governor-General may appoint one member as representative of persons for the time being engaged in business as manufacturers of dairy-produce, or as sellers of such produce out of New Zealand, whether as agents or on their own account. Such member shall be appointed for a term of three years, but may at any time be removed from office by the Governor-General, on the recommendation of the Board, or may from time to time be reappointed on the expiry of any term of appointment.

(4.) Of the producers' representatives six shall be elected in the prescribed manner by direct vote of the producers carrying on business in the North

Island, and three shall be similarly elected by producers carrying on business in the South Island.

(5.) Every person appointed as a Government representative under this section shall hold office during the pleasure of the Governor-General.

(6.) With respect to the first members appointed as producers' representatives the following provisions shall apply: (*a*.) Three of such members shall retire on the thirtieth day of June in each of the years nineteen hundred and twenty-five, nineteen hundred and twenty-six, and nineteen hundred and twenty-seven. (*b*.) The members so to retire in any year shall be determined by lot, save that in each of the said years two representatives from the North Island and one representative from the South Island shall retire. (*c*.) Any member retiring as aforesaid shall be eligible for reappointment to the Board.

(7.) Except as provided in the last preceding subsection, every person appointed as a producers' representative shall hold office for a period of three years from the date of his appointment, save that he may be reappointed in the manner prescribed by paragraph (*b*) of subsection two hereof, or may at any time be removed from office by the Governor-General, on the recommendation of the Board.

(8.) On the death, resignation, or removal from office of any member of the Board appointed as a producers' representative the Governor-General shall, on the recommendation of the Board, appoint some fit person to be a member of the Board for the residue of the term for which such first-mentioned person was appointed.

(9.) The powers hereinafter conferred on the Board shall not be affected by any vacancy in the membership thereof.

5. The Board shall be a body corporate, with perpetual succession and a common seal, and shall be capable of holding real and personal property, and of doing and suffering all that bodies corporate may do and suffer.

6. (1.) Any contract which, if made between private persons, must be by deed shall, if made by the Board, be in writing under the seal of the Board.

(2.) Any contract which, if made between private persons, must be in writing signed by the parties to be charged therewith shall, if made by the Board, be either under the seal of the Board or signed by two members of the Board on behalf of and by direction of the Board.

(3.) Any contract which, if made between private persons, may be made verbally without writing may be similarly made by or on behalf of the Board by any two members acting by direction of the Board, but no verbal contract shall be made for any sum exceeding twenty pounds.

7. (1.) In any case in which the Governor-General is satisfied that any member of the Board is incapacitated by illness, absence, or other sufficient cause from performing the duties of his office, the Governor-General, on the recommendation of the Minister of Agriculture if the member so incapacitated is a Government representative, or on the recommendation of the Board in any other case, may appoint some fit person to be named by the Minister or the Board, as the case may require, to be a deputy to act for that member during such incapacity; and any deputy shall, while he acts as such, have all the powers and authority of the member for whom he is so acting.

(2.) No such appointment of a deputy and no acts done by him as such shall in any proceedings be questioned on the ground that the occasion for his appointment had not arisen or had ceased.

8. (1.) The first meeting of the Board shall be held on a day to be appointed in that behalf by the Minister of Agriculture.

(2.) At the first meeting the Board shall appoint one of its members to be the Chairman of the Board.

(3.) On the second Wednesday in July, nineteen hundred and twenty-four, and on the same day in each succeeding year, the Board shall hold a meeting for the purpose of appointing a Chairman for the ensuing twelve months.

(4.) Any person appointed as the Chairman of the Board shall hold office until the appointment of his successor in accordance with this section, and shall be eligible for reappointment.

9. (1.) Except as provided in the last preceding section, meetings of the Board shall be held at such times and places as the Board shall from time to time appoint.

(2.) The Chairman of the Board, or any four members thereof, may at any time call a special meeting of the Board.

(3.) At all meetings of the Board five members (of whom at least one shall be a Government representative) shall form a quorum.

(4.) The Chairman shall preside at all meetings of the Board at which he is present.

(5.) In the event of the absence of the Chairman from any meeting of the Board the members present at such meeting shall appoint one of their number to be the chairman of the meeting.

(6.) At any meeting of the Board the Chairman shall have a deliberative vote, and in the case of an equality of votes shall also have a casting-vote, and a decision of the majority of the members present shall be the decision of the Board.

10. The Board may appoint such officers as it deems necessary for the efficient carrying-out of its functions under this Act.

London Agency of Board.

11. (1.) There is hereby also constituted an agency of the Board in London (hereinafter called the London Agency), which shall consist of such number of persons as the Board may decide from time to time, one of whom shall be appointed by the Governor-General, on the recommendation of the Minister of Agriculture, and shall hold office during his pleasure.

(2.) The other members of the London Agency shall be appointed by the Board, and shall hold office during the pleasure of the Board.

(3.) It shall be the duty of the London Agency to keep the Board advised as to current prices of dairy-produce, and as to other matters relative to the disposal of New Zealand dairy-produce in England or elsewhere, and generally to act as the agent of the Board in accordance with the directions of the Board.

Dairy-produce not to be exported save in accordance with Determination of Board.

12. For the purpose of enabling the Board effectively to control the export, sale, and distribution of New Zealand dairy-produce the Governor-General may, acting under the powers conferred on him by the Customs Act, 1913, and its amendments, prohibit the export from New Zealand of any dairy-produce save in accordance with a license to be issued by the Minister of Agriculture, subject to such conditions and restrictions as may be approved by the Board.

Board may assume Control of Dairy-produce intended for Export.

13. (1.) The Board is hereby empowered to determine from time to time the extent to which it is necessary, for the effective operation of this Act and the fulfilment of its purposes, that the Board should exercise control over the export of dairy-produce from New Zealand, and may assume control of any such dairy-produce accordingly.

(2.) In any such case the control of the Board shall operate as from a time to be specified in that behalf by the Board by notice given in conformity with this Act.

(3.) Notice by the Board of its intention to assume control of any dairy-produce may be given either by service on the owner of any dairy-produce or on any person having possession thereof, or by publication in any newspaper or newspapers, in accordance with such conditions as may be prescribed. Every such notice shall, subject to the provisions of this Act, have effect according to its tenor.

(4.) The control to be exercised by the Board over any dairy-produce may, as the Board in any case determines, be absolute or limited.

(5.) All dairy-produce of which the Board has assumed absolute control shall be shipped as the Board directs, and shall be sold and disposed of only by the Board, or by direction of the Board, at such times and in such manner and on such terms as the Board in its discretion determines.

(6.) Where the Board has assumed limited control the extent of its control shall be defined by notice as aforesaid, or by agreement between the Board and the owners of the dairy-produce or other persons having authority to enter into an agreement with the Board with respect to such dairy-produce.

(7.) Notwithstanding anything to the contrary in the foregoing provisions of this section, the Board shall not exercise its powers under this section with respect to the sale of any dairy-produce if the Board is satisfied—(*a*) That there is subsisting a contract for the purchase and sale of that dairy-produce made before the commencement of this Act, or (*b*) that there is subsisting a contract for the purchase and sale of that dairy-produce made after the commencement of this Act but before the Board has given notice of its intention to assume control of that dairy-produce, and that the dairy-produce to which any such contract as aforesaid relates is to be exported from New Zealand not later than the thirty-first day of August, nineteen hundred and twenty-four.

(8.) Notwithstanding anything to the contrary in the foregoing provisions of this section, the Board shall not exercise its powers under this section with respect to the sale of any dairy-produce so as prejudicially to affect the operation of any contract of agency in respect of the sale of dairy-produce out of New Zealand if such contract has been entered into in writing on or before the first day of July, nineteen hundred and twenty-three.

Contracts for Shipment of Dairy-produce.

14. (1.) After the constitution of the Board, or after such later date as the Board may by public notice appoint, no contract for the carriage by sea of any dairy-produce to be exported from New Zealand shall be made save by the Board acting as the agent of the owners of that dairy-produce or of other persons having authority to export the same, or in conformity with conditions to be approved by the Board: Provided that if the Board established under the Meat-export Control Act, 1921–22, by resolution notified to the Board under this Act, determines not to enter into any contract for the sea carriage of meat save in accordance with an arrangement between that Board and the Board under this Act, the Board under this Act shall not, while such resolution remains in force, have authority to enter into any contract for the sea carriage of dairy-produce save in accordance with an arrangement to be made with the Meat-producers Board.

(2.) Every contract for the carriage of dairy-produce by sea made otherwise than in conformity with this section shall be void.

(3.) Every person other than the Board who, after the constitution of the Board, or after such later date as aforesaid, exports any dairy-produce from New Zealand shall, on making entry therefor under the Customs Acts and before such entry has been passed, produce to the Collector or other officer of Customs sufficient evidence to satisfy him that the contract for the shipment of that dairy-produce has been approved by the Board.

(4.) The foregoing provisions of this section shall apply, with the necessary modifications, to contracts made before the constitution of the Board (whether before or after the commencement of this Act), save that the approval of the Board shall not be required for any such contract if the dairy-produce to which it relates is exported from New Zealand not later than the thirty-first day of August, nineteen hundred and twenty-four.

Levy on Dairy-produce exported from New Zealand.

15. (1.) There shall be paid by way of levy on all dairy-produce exported from New Zealand after a date to be fixed in that behalf by the Governor-General in Council, whether such dairy-produce is subject to the control of the Board or not, such charges as may from time to time be fixed by the Board, not exceeding the maximum charges that may be prescribed in that behalf by regulations under this Act (being not more in any case than one-eighth of a penny in respect of each pound of butter and one-sixteenth of a penny in respect of each pound of cheese exported as aforesaid).

(2.) All moneys payable under this section in respect of any dairy-produce shall be paid to the Collector of Customs on or before the entry of that dairy-produce for export, and shall be paid into the Consolidated Fund.

(3.) The net amounts paid into the Consolidated Fund as aforesaid, after deducting such proportion as may be prescribed in respect of the services of the Collectors and other officers of Customs, shall from time to time be paid to the Board without further appropriation than this section, and shall form part of the funds of the Board.

Particular Powers of Board.

16. (1.) Without limiting any authority specifically conferred on the Board with respect to any dairy-produce, the Board shall have full authority to make such arrangements and give such directions as it thinks proper for the following matters: (*a*) For the handling, pooling, and storage of dairy-produce; (*b*) for the shipment of such dairy-produce on such terms and in such quantities as it thinks fit; (*c*) for the sale and disposal of dairy-produce on such terms as it thinks advisable; (*d*) for the insurance against loss of any such dairy-produce either in New Zealand or in transit from New Zealand and until disposed of; and (*e*) generally for all such matters as are necessary for the due discharge of its functions in handling, distributing, and disposing of New Zealand dairy-produce.

(2.) For the purpose of securing any advances that may be made to the Board or to the owners of any dairy-produce at the request of the Board the Board shall, by virtue of this Act and without further authority, have full power on behalf of the owners to give security over such dairy-produce and to execute all mortgages and other instruments of assurance in the same manner in all respects as if the Board were the legal owners of such dairy-produce.

Application by Board of Moneys received by it.

17. All moneys received by the Board by way of levy under section fifteen hereof or in respect of the sale of dairy-produce or otherwise howsoever shall be paid by the Board into a separate account at a bank to be approved by the Minister of Finance, and shall be applied by the Board as follows: (*a*) In payment of the expenses, commission, and other charges incurred by the Board or for which the Board may become liable in the course of its business; (*b*) in payment of the salaries and wages of officers and servants of the Board; (*c*) in payment of travelling-allowances, fees, or other remuneration to members of the Board or of the London Agency (not being persons permanently employed in the service of the Government); (*d*) in payment of advances made by the Board to the owners of any dairy-produce on account of the price of that dairy-produce; (*e*) in payment into a reserve fund, from time to time as the Board in its discretion determines, of such amounts, not exceeding in any year the maximum amount levied for that year under section fifteen hereof, as the Board may consider necessary to enable it to carry on its operations under this Act; (*f*) in payment of the balance to the owners of dairy-produce controlled by the Board in proportions to be fixed by the Board by reference to the quantity and grade of the dairy-produce handled by the Board in respect of the several producers or other owners of dairy-produce.

Audit of Accounts.

18. The accounts of the Board shall be subject to audit in the same manner in all respects as if the moneys of the Board were public moneys within the meaning of the Public Revenues Act, 1910.

Liability of Board for its Acts or Omissions.

19. (1.) The Board in its corporate capacity shall in all its operations under this Act be deemed to be the agent of the owners of all dairy-produce of which the Board has assumed control; and the mutual rights, obligations, and liabilities of the Board and the several owners shall accordingly be determined in accordance with the law governing the relations between principals and agents, save that nothing herein shall be construed to limit the power of the Board to exercise, without the authority of the owner of any dairy-produce, any power with respect to such dairy-produce that may expressly or by implication be conferred on the Board by or by virtue of this Act.

(2.) The members of the Board shall not be personally liable for any act or default of the Board done or omitted to be done in good faith in the course of the operations of the Board.

Regulations.

20. For the purpose of enabling the Board to carry out its functions under this Act the Governor-General may make regulations prescribing the maximum charges to be paid by way of levy in respect of dairy-produce exported from New Zealand, and all such other regulations as he thinks necessary for the purpose of enabling this Act to be carried into effect.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society: Hastings, 17th and 18th October.
Poverty Bay A. and P. Association: Gisborne, 23rd and 24th October.
Marlborough A. and P. Association: Blenheim, 24th and 25th October.
Timaru A. and P. Association: Timaru, 24th and 25th October.
Wairarapa P. and A. Society: Carterton, 24th and 25th October.
Manawatu A. and P. Assn.: Palmerston North, 30th and 31st Oct. and 1st Nov.
Ashburton A. and P. Association: Ashburton, 31st October and 1st November.
Wanganui A. and P. Association: Wanganui, 7th and 8th November.
Canterbury A. and P. Association: Christchurch, 8th and 9th November.
Egmont A. and P. Association: Hawera, 14th and 15th November.
Waikato A. and P. Association: Hamilton, 20th and 21st November.
North Otago A. and P. Association: Oamaru, 21st and 22nd November.
Stratford A. and P. Association: Stratford, 21st and 22nd November
South Otago A. and P. Association: Balclutha, 22nd and 23rd November.
Otago A. and P. Society: Dunedin, 28th and 29th November.
Southland A. and P. Association: Invercargill, 11th and 12th December.
Feilding I., A., and P. Association: Feilding, 5th and 6th February.
Clevedon A. and P. Association: Clevedon, 9th February.
Dannevirke A. and P. Association: Dannevirke, 13th and 14th February.
Taranaki Metropolitan Agricultural Society: New Plymouth, 5th and 6th March.
Waikato Central Agricultural Association: Cambridge, 5th and 6th March.
Methven A. and P. Association: Methven, 27th March.

(Agricultural and Pastoral Association secretaries are invited to supply dates and location of their shows.)

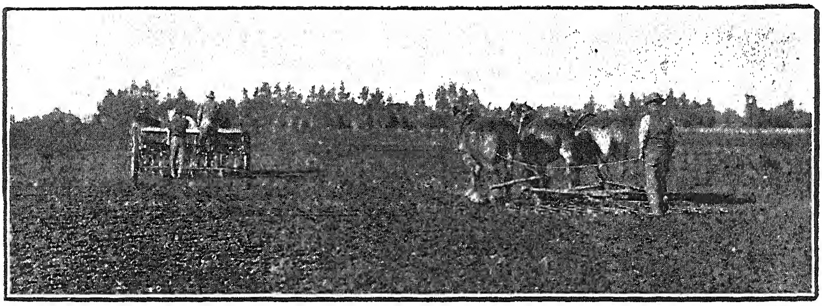
Rural Credit Associations Act.—Under the Finance Act, 1923, are repealed subsections (2), (3), (4), and (5) of section 6 of the Rural Credit Associations Act, 1922, the text of which was published in the *Journal* for December, 1922. Section 6 deals with the liability of members for the debts of the association, and the subsections now repealed made such debts a charge on the assets of the members, with priority over all other charges created after the incorporation of the association.

Presents of New Zealand Lamb.—In order to advertise New Zealand lamb, arrangements have been made by the New Zealand Meat-producers Board, through its London Office, to deliver single carcases of prime New Zealand lamb to any address in Great Britain for the sum of £1 13s. per carcase. All that is necessary is to remit that sum to the Secretary of the Meat-producers Board, P.O. Box 121, Wellington, together with the friend's full address.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 8th August: Peas—Prices for New Zealand partridge declined during the strike to 67s. 6d. per quarter c.i.f., but have recovered, and are now 77s. 6d. to 80s. ex store, though demand is slow. Tasmanian maple afloat are offered at 91s. Market is firm for blue. Prices of Japanese are affected by the earthquake, and have advanced 50s. to 90s. per ton; £20 per ton is asked for Tasmanian afloat; for good quality New Zealand near-at-hand shipments values are about £18. Beans—Market quiet. New Zealand nominally quoted at 50s. to 52s. per quarter, ex store.

Hubam Clover.—New-Zealand-grown seed of Hubam clover is obtainable from the Honey-producers' Association, Stanley Street, Auckland. The plant is an annual—not a biennial as stated in last month's *Journal.*

Moumahaki Ayrshires.—A good opportunity exists at present for private purchase of stock from the Ayrshire herd of the Moumahaki Experimental Farm, near Waverley, there being a few yearling heifers and bulls available.



The New Zealand

Journal of Agriculture.

VOL. XXVII.—NO. 4.

WELLINGTON, 20TH OCTOBER, 1923.

DAIRY-HERD-TESTING ASSOCIATIONS.

REVIEW OF OPERATIONS FOR 1922–23 SEASON.

W. M. SINGLETON, Director of the Dairy Division.

THE herd-testing matter published from time to time in the *Journal* has indicated the rapidly increasing popularity of the association system in the Dominion, the records of over 84,000 cows having been ascertained by this method during last season. We are now able to give a summarized review of the 1922–23 season's figures available. The season itself was a most remarkable one for pasture-growth, and probably more favourable in general than the 1921–22 period. The fact that so large a number of herds were tested for the first time last season has somewhat decreased the association average yield as compared with the preceding year; but, all things considered, it must be accepted that the yield of the average cow under association test in New Zealand is very creditable.

For the 1922–23 season there were in operation 137 associations, fifty-seven of which, representing 34,558 cows, were controlled by officers of the Dairy Division. Of these fifty-seven associations average yields for fifty-six have been compiled, the remaining association having failed to continue sufficiently long to warrant including its figures in the present summaries.

The following tabulated statement gives the position so far as associations conducted by Dairy Division officers are concerned :—

Table 1.—Summary of Associations conducted by Dairy Division Officers (all Cows in Milk 100 Days and over included), 1921–22 and 1922–23.

	1921–22.	1922–23.
Number of associations	50	56
Number of herds	901	1,184
Number of cows	21,087	28,146
Average number of herds per association.. ..	18	21
Average number of cows per herd	23	24
Average number of cows per association	422	503

This shows an increase of six associations, 283 herds, and 7,059 cows. It may be mentioned, however, that although there is an increase of only six associations, eleven new ones are represented, five of the old ones having been taken off the Division's hands.

The next table, again covering associations with records figured by officers of the Division, shows the average production of all cows in milk for 100 days and over. It will be seen that the average cow yielded 232·99 lb. butterfat in 227 days.

Table 2.—Averages of all Cows in Milk 100 Days and over, for Associations conducted by Dairy Division Officers (56 Associations, 1,184 Herds, 28,146 Cows), 1922–23.

Association No.	Number of Cows.	Association Average.		Highest Herd-yield in Association.		Lowest Herd-yield in Association.	
		Days.	Butterfat.	Days.	Butterfat.	Days.	Butterfat.
			lb.		lb.		lb.
1	191	242	229·05	207	262·44	240	211·60
2	511	204	184·35	274	292·74	135	87·75
3	632	206	186·13	253	253·58	122	99·71
4	132	240	234·98	257	322·53	121	93·91
5	568	243	272·34	287	462·51	192	172·57
6	1,127	239	265·22	293	413·95	182	145·82
7	64	204	186·98	207	229·45	119	108·07
8	1,266	244	281·96	278	445·03	130	85·46
9	299	220	230·94	251	294·15	127	164·28
10	723	233	260·06	293	393·91	147	169·39
11	162	231	253·62	303	348·14	119	143·54
12	1,244	191	178·98	275	318·87	141	64·06
13	1,052	196	175·64	256	295·44	109	75·73
14	216	252	279·85	279	391·39	197	221·21
15	1,331	252	279·88	282	359·80	210	212·72
16	1,240	211	206·57	251	316·61	206	109·72
17	407	257	299·64	292	443·76	120	108·53
18	2,825	214	167·79	277	291·73	166	90·32
19	244	241	253·73	270	309·58	142	109·50
20	1,698	245	281·87	312	391·00	210	194·68
21	97	224	221·73	232	279·62	123	126·47
22	774	211	224·82	276	358·98	119	82·50
23	117	248	285·53	254	347·22	155	167·36
24	620	264	286·60	288	382·94	133	165·67
25	175	266	268·83	273	287·29	241	239·48
26	240	254	253·08	273	331·78	124	147·08
27	328	268	275·06	296	356·88	217	204·88

Table 2—continued.

Association No.	Number of Cows.	Association Average.		Highest Herd-yield in Association.		Lowest Herd-yield in Association.	
		Days.	Butterfat.	Days.	Butterfat.	Days.	Butterfat.
			lb.		lb.		lb.
28	213	240	235·74	269	344·33	210	161·07
29	386	267	304·75	298	355·98	139	121·81
30	186	236	240·81	256	322·27	106	122·96
31	459	232	252·38	269	299·46	216	198·11
32	659	249	267·61	263	330·23	111	122·06
33	53	185	219·77	239	282·41	155	184·77
34	719	203	214·55	255	381·74	100	114·25
35	122	220	224·46	280	318·59	136	116·60
36	355	243	235·60	212	345·61	168	120·79
37	146	256	270·73	291	391·39	207	211·73
38	657	238	222·56	292	312·17	123	129·59
39	335	226	244·33	242	335·58	167	151·63
40	266	214	232·37	252	364·50	137	90·87
41*	13	281	366·37	..	..	..	..
42	525	158	194·77	153	241·59	153	127·95
43	804	195	202·87	264	333·17	120	66·51
44	23	213	208·65	244	274·56	152	139·31
45	500	254	276·11	296	364·64	249	233·89
46	155	250	262·71	304	376·09	233	210·15
47	246	213	248·33	281	332·59	118	112·57
48	274	236	230·49	282	325·62	205	168·11
49	375	254	241·61	257	393·32	147	160·63
50	299	215	200·55	218	285·74	109	100·72
51	115	273	311·47	292	407·69	212	226·37
52	315	240	280·68	260	342·52	162	152·96
53	390	218	223·03	239	293·81	116	117·75
54	205	272	310·91	324	518·93	200	221·19
55	905	197	171·55	263	395·80	236	87·10
56	163	226	263·98	236	407·86	116	177·20

* One herd only in association average, and therefore not counted as highest association average.

	Days.	Pounds Butterfat.
Grand average of all cows	227	232·99
Highest association average	273	311·47
Lowest association average	214	167·79
Highest individual herd	324	518·93
Lowest individual herd	141	64·06
Highest individual cow	296	660·83
Lowest individual cow	105	26·22
Average daily production of butterfat per cow ..		1·0269

Comparing these figures with the preceding year's summary (*Journal*, August, 1922), it is shown that the average production of butterfat has decreased by 7·34 lb., and that there is a decrease of three days in the average number of days in milk. If, however, we add on three more days at 1·0269 lb. fat per day, or 3·08 lb. for the three days, the season's decrease is only 4·26 lb. butterfat, and the percentage decrease in average butterfat per cow per day only 1·77.

It has not been possible to collect complete data regarding the past season's average yield for privately conducted associations, but we have been able to gather figures for twenty-five associations, representing

22,537 cows. The figures are summarized in the following table, which, in keeping with figures quoted hereinbefore, is based on all cows in milk 100 days and over:—

Table 3.—Averages of all Cows in Milk 100 Days and over, for certain privately conducted Associations (25 Associations, 901 Herds, 22,537 Cows), 1922–23.*

Association No.	Number of Cows.	Association Average.		Highest Herd-yield in Association.		Lowest Herd-yield in Association.	
		Days.	Butterfat.	Days.	Butterfat.	Days.	Butterfat.
			lb.		lb.		lb.
1	405	248	292·52	280	424·11	239	251·14
2	313	223	233·75	265	298·14	193	181·14
3	2,500	245	266·61	272	381·22	194	137·13
4	1,400	165	171·04	278	404·06	186	155·87
5	371	182	165·53	118	205·94	120	87·49
6	275	258	269·56	256	348·06	236	196·83
7	180	213	225·26	229	255·90	204	192·58
8	494	173	174·07	231	309·67	110	69·20
9	160	211	245·66	290	490·30	180	190·20
10	1,200	231	225·00	277	446·71	209	93·88
11	1,530	234	268·60	292	488·04	236	191·59
12	1,893	222	232·36	266	390·44	205	135·12
13	316	212	217·19	225	261·71	197	178·88
14	1,989	170	159·49	145	204·87	199	125·42
15	1,100	253	242·11	279	373·42	283	197·42
16	145	225	243·71	267	317·70	182	127·87
17	1,957	259	277·80	312	373·75	203	121·22
18	208	184	176·00	244	247·00	160	105·00
19	281	240	247·85	264	362·35	189	193·71
20	432	246	256·56	278	332·62	200	151·35
21	240	207	225·25	253	282·70	106	118·00
22	563	242	291·40	266	371·37	187	220·47
23	2,220	236	242·53	275	336·52	161	149·89
24	787	246	274·54	321	488·54	239	225·35
25	1,578	216	223·14	232	418·63	256	172·22

* Number of herds in Association No. 23 estimated as 85.

	Days.	Pounds Butterfat.
Grand average of all cows	224	234·85
Highest association average	248	292·52
Lowest association average	170	159·49
Highest individual herd	290	490·30
Lowest individual herd	110	69·20
Highest individual cow	*	739·41
Lowest individual cow	120†	44·00
Average daily production of butterfat per cow ..		1·049

* Days in milk not given; second cow, 293 days, 668·81 lb. fat. † Second lowest cow, 213 days, 52·3 lb. fat.

It may be stated that, although all dairy companies interested in this work were circularized for information regarding cow-testing returns, we have been unable to procure figures for the remaining fifty-five groups, representing 26,901 cows. It has been ascertained that many associations fail to keep adequate records, merely figuring the returns and passing them on to the members, or else forwarding the sheets with the tests included, leaving the association member to

do his own figuring. As the majority of dairy-farmers have not the time or the facilities to do the work properly, this method is by no means satisfactory, and accounts in many instances for the gradual dwindling of interest and the final cessation of operations. Apart from this, it may be mentioned that much value can be obtained from periodic and annual summaries. We would therefore urge the secretaries of privately conducted associations to compile these, as they not only form a valuable record for subsequent comparison, but create interest among the members themselves. Any reasonable service which tends to encourage interest among the association members should be adopted, for without interest and enthusiasm the movement cannot prosper.

Combining Tables 2 and 3, it is found that the 50,683 cows comprised showed an average production of 233·82 lb. of butterfat in 226 days. For the preceding season we were able to compile figures from 21,087 cows, the average production being 240·33 lb. of butterfat in 230 days. There is shown, therefore, a small decrease in the production of the average cow in milk 100 days and over. Seeing, however, that the 1922–23 figures are for more than double the number of cows, representing many new herds, this decrease carries little significance. It will be apparent from these two tables that the inclusion this year of a summary of results from twenty-five privately controlled associations has not detrimentally affected the grand average, as the averages of Tables 2 and 3 are practically equal; in fact, the average for Table 3 is the higher of the two.

Now, while the average yield of cows in milk 100 days and over may indicate what the average cow under association test actually produced, it is not altogether a fair indication of what the average dairy cow is capable of producing, because cows culled in the early stages of their testing-period, and animals sold, or withdrawn through sickness or other causes, are included. We therefore consider that 210 days is nearer the average normal lactation period, and have accordingly included all records available for this duration in the following Table 4. This represents only associations controlled by the Dairy Division, as we were unable to procure from privately conducted associations summaries of this nature.

Table 4.—Averages of all Cows in Milk 210 Days and over, for Associations conducted by Dairy Division Officers (56 Associations, 970 Herds, 18,747 Cows), 1922–23.

Association No.	Number of Cows.	Association Average.		Highest Herd-yield in Association.		Lowest Herd-yield in Association.	
		Days.	Butterfat.	Days.	Butterfat.	Days.	Butterfat.
			lb.		lb.		lb.
1	154	259	243·60	228	295·21	264	240·05
2	246	248	225·23	274	292·74	221	166·09
3	309	243	216·54	253	253·58	216	150·72
4	109	260	254·21	257	322·53	258	212·87
5	437	263	298·50	287	462·51	221	205·00
6	832	263	288·07	298	430·28	215	175·45
7	32	259	204·78	244	273·29	264	181·94

Table 4—continued.

Association No.	Number of Cows.	Association Average.		Highest Herd-yield in Association.		Lowest Herd-yield in Association.	
		Days.	Butterfat.	Days.	Butterfat.	Days.	Butterfat.
			lb.		lb.		lb.
8	1,034	260	304·08	278	445·03	214	212·42
9	184	262	270·35	263	311·13	263	215·75
10	522	260	286·73	297	402·37	229	164·85
11	107	271	295·26	303	348·14	248	238·73
12	450	239	223·46	295	349·45	219	114·47
13	477	236	219·81	255	292·39	221	120·47
14	179	268	293·08	289	400·78	225	233·23
15	1,171	264	292·34	282	359·80	240	232·68
16	693	247	244·77	251	316·61	250	137·02
17	337	276	321·66	292	443·76	281	252·77
18	1,689	246	192·89	239	298·10	235	109·02
19	197	256	267·87	273	309·73	239	202·62
20	1,321	267	301·05	313	391·01	231	206·22
21	72	252	246·87	241	285·84	261	237·25
22	412	252	276·28	288	375·00	218	138·45
23	91	274	314·25	273	370·00	254	285·29
24	561	276	298·37	288	382·94	261	186·07
25	161	276	278·13	273	287·29	248	255·07
26	208	269	269·24	273	331·78	268	233·57
27	300	276	283·97	288	361·11	286	240·92
28	169	256	257·81	269	344·33	261	185·85
29	342	277	312·82	298	355·98	283	251·86
30	151	260	265·02	276	356·39	258	224·52
31	380	242	263·66	269	299·46	225	235·61
32	579	260	279·63	267	334·02	238	162·98
33	15	252	297·52	*	*	*	*
34	377	237	254·22	227	431·83	222	189·91
35	64	268	269·77	290	327·22	261	222·40
36	298	258	242·79	256	438·52	235	157·34
37	127	268	283·46	291	391·39	274	226·79
38	483	269	252·69	299	310·75	253	200·90
39	204	259	282·39	255	369·10	223	211·07
40	147	255	275·23	252	364·50	213	193·22
41	13	281	366·37	*	*	*	*
42	8	216	246·47	210	279·74	217	184·33
43	302	248	245·94	224	339·35	247	194·32
44	14	252	253·23	244	274·56	264	224·79
45	419	269	292·26	296	364·64	268	254·53
46	131	262	279·37	304	376·09	246	228·76
47	141	254	297·92	285	335·86	214	226·45
48	203	256	261·10	282	325·62	233	201·78
49	325	266	254·47	257	392·32	254	162·82
50	184	248	223·62	233	312·44	222	159·28
51	108	278	317·69	292	407·69	223	227·85
52	263	252	298·22	269	352·40	232	196·25
53	251	249	251·96	264	475·92	241	194·26
54	187	281	318·90	324	518·93	247	238·52
55	463	236	214·16	263	395·80	236	87·10
56	114	256	295·52	247	427·60	234	239·11

* One herd only in association average.

	Days.	Pounds Butterfat.
Grand average of all cows	258	267·10
Highest association average	276	321·66
Lowest association average	246	192·89

	Days.	Pounds Butterfat.
Highest individual herd	324	518·93
Lowest individual herd	236	87·10
Highest individual cow	296	660·83
Lowest individual cow	214	47·90
Average daily production of butterfat per cow ..		1·0355

For purposes of comparison it may be mentioned that for the season 1921–22 there were included in a similar summary 9,101 cows, averaging 271·48 lb. butterfat in 261 days. This year's figures from 18,747 cows show a decrease of 4·38 lb. butterfat and 3 days, but, considering the greatly increased number of cows, this may be regarded as almost negligible.

Comparing those associations which were in operation during both the two last seasons and for which summaries on the 210-day-and-over basis were prepared, it is found that twenty out of a total of thirty-two show an increase for last season over the preceding, while the remaining twelve show a decrease. The largest increase was one of 54·76 lb. butterfat on an average yield of 228·70 lb., which represents 24 per cent., the average days being practically the same. The largest decrease was one of 82·62 lb. on 326·22 lb., or 25·3 per cent. This was probably due to the number of days being less, and to the fact that many new herds had joined the association, while some of the old ones had fallen out. It must also be kept in mind that 326·22 lb. butterfat is a high average, and is therefore more susceptible to seasonal and other influences. This case is typical of the twelve associations which showed decreases, since all had been running for four or more years, with the exception of three, which had been in operation for three years, the decreases for the latter three being small. It has been noticed that after the third or fourth year of continuous operation association averages will often be found to go back somewhat. This may be accounted for by the fact that after three or four years of testing, with its resultant culling and selection, the average production of a herd reaches that stage where further increase is difficult, and where feed, care, and general conditions bear a more marked influence. About this stage also we find that the personnel of the older-established associations changes, many of the original members discontinuing—for a time at least. This also tends to decrease the average, which in due course will, as the result of culling and selection in the newer herds, rise again. It is this changing of members which makes it difficult by means of figures relating to association averages to truly show what improvement has been effected, the newer herds nullifying the increases in the older.

Comparing the same thirty-two associations referred to previously, it has been found that as between the two past seasons there is an increase of 1·8 per cent., the average production having risen from 271 lb. butterfat in 261 days to 275·87 lb. in 263 days, the number of cows being 8,140 and 7,899 respectively. To obtain the true course of an association's activities, however, it would be necessary to compare the same herds, rather than the same association, from season to season. Could this be done we feel confident the figures would show a larger increase.

It has been estimated that the average dairy cow in New Zealand yields approximately 168·42 lb. of butterfat per season, while the

records available, which are for 50,683 cows, show that the average cow under association test, and in milk 100 days and over, produced during the past season 233·82 lb. butterfat. We recognize that the majority of the herd-testing association members are the more progressive dairy-farmers, but we believe that if every dairy-farmer would test his cows, and study his records and act on them, it is reasonable to expect that the whole of our dairy cows could be brought to the average production of those tested. The difference in yield is roundly 66 lb. butterfat, and there are 1,248,643 dairy cows in the Dominion. Taking the value of butterfat at 1s. 6d. per pound, this represents, on an average production of 168·42 lb. butterfat, £15,772,234, whereas on 233·82 lb. it equals £21,896,828, a difference of no less than £6,124,594.

The opening-up of new land for dairying absorbs a large proportion of our poorer cows, but it may now be expected that each year, with more intensive dairying, there will be more scope for the selection of the better dairy cow, and when testing becomes more nearly general the cull-cow problem should largely settle itself. The association testing-system will therefore be a much more powerful instrument than formerly for the improvement of our dairy herds.

The present opportunity is taken to thank those dairy companies which were good enough to supply us with annual summaries of results for associations under their control. The Dairy Division is endeavouring to collect the fullest possible data regarding the production of our dairy cows, and any statistics which those conducting this work are able to supply will be always appreciated.

WALLACEVILLE VETERINARY LABORATORY.

THE annual report of the Department of Agriculture for 1922–23 summarizes the work of the Wallaceville Laboratory during that period as follows:—

In the course of the year 1,632 specimens were received for examination. These included milk-samples, pathological exhibits, blood for serological tests, water for bacteriological analysis, &c; 1,051 samples of milk from cases of suspected contagious mastitis were dealt with, and 231 samples of blood were examined by the agglutination method for the detection of contagious abortion. In addition, 106 composite samples of milk were received for test inoculations for the presence of tubercle bacilli; only one sample proved to be tubercular. Owing to the necessity for curtailing expenditure the prosecution of research work has been restricted. The curative treatment of contagious mammitis received attention; whenever available, subjects in the locality affected with this disease were secured for experimental treatment. Parasitic gastritis occurring among sheep and imported pedigree goats at the laboratory provided an opportunity to test the method advocated by the South African Veterinary Service of dosing with a mixture of arsenite of soda and sulphate of copper. This treatment in our hands proved most effective. A number of feeding experiments to test the toxicity of certain materials were carried out. Among these may be mentioned the effects of basic-slag absorption by sheep, the effects of feeding salt to swine, the feeding of clover raised upon soil from "bush-sick" areas; also tests with samples of calf-meal, honey, and mangold-liquor. The breeding of ferrets for disposal to settlers was continued, and a small herd of pedigree goats was maintained on the laboratory farm for disposal in the same manner. 78,200 doses of blackleg vaccine were supplied. Abortion vaccine in the shape of living cultures of the specific organism was supplied on request; 1,612 c.c. of tuberculin were sent out, and sixty-three doses of mallein were supplied.

SOME SOILS OF OTAGO PENINSULA.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

OTAGO Peninsula is one of those remarkable areas of volcanic origin in the South Island which occur as prominent features of the coast-line physiography, but which rarely occur far from the coast, and then only in unimportant masses. Banks Peninsula and Otago Peninsula, with their related contiguous areas, are the two great instances of this type of country that the South Island affords, which are highly important from an agricultural viewpoint, and therefore deserving of intensive study. As an instalment towards this consummation the following notes are offered.

Otago Peninsula was originally an island, isolated as a result of a submergence which drowned two valleys and the divide between their heads, forming a strait. The peninsula is now joined to the mainland by a sandy isthmus which originated as a bar across the southern entrance to the strait (Cotton, 1922). Over this isthmus runs the Anderson's Bay Road—the land means of access to the peninsula. In the early days of the Otago Settlement the country was forested, but now only isolated patches of "bush" remain, and the whole occupied area is practically devoted to dairy-farming. The peninsula presents some notable geological features. On the ocean or south-east side the sand has blown up from Sandfly Bay over a mountain more than 1,000 ft. high, so that as far as altitude is concerned Sandymount may be considered one of the most remarkable sandhills of the Dominion. Near here is also a blowhole and some basaltic pillars which are among the finest to be seen in New Zealand.

In February, 1920, the writer was able to pay a visit to this district and to collect a few samples from the waste and other virgin lands which appeared likely to afford interesting information. The dune-sands of the coast were collected from two widely separated localities, and proved rich in mineral plant-foods, similarly to some sands of the North Island described in the *Journal* for May, 1920, page 274. Littoral soils of a volcanic origin, subject to the action of sea-spray or of sea-inundation, were also collected, and show a very high potash content, while phosphate was present in good proportion. In a virgin forest soil at good elevation and derived from a volcanic rock all plant-food was found to be present in good degree. This soil was classified as a silt loam, and would be much heavier to work if it were not for the excellent effect of the high amount of organic matter present.

Only two samples were collected which did not represent virgin soils. One on Tomahawk Head, down in good pasture, appears to have been depleted in phosphate, other plant-foods being present in good proportion. The other was from a grassed paddock on the slopes of Harbour Cone. This soil was extremely rich in available phosphate and potash, and exhibited a well-nigh perfect mechanical composition

or texture. This Harbour Cone soil is not singular among peninsula soils in its high phosphate content. A soil from North-east Harbour which contained 0·04 per cent. of available phosphoric acid yielded in 1908 41½ tons of turnips per acre without any manure.*

Sandy soils derived from the dune-sands of the coast occupy a comparatively large area of the low-level soils of the peninsula, and if the results obtained can be taken as true for the whole of these soils it is time that some scheme of improvement were set on foot ultimately to enable them to be grassed.

Further investigation of the soils of the Dunedin area will be proceeded with as time and opportunity afford, with a view to the completion of a soil survey.

NOTES ON THE SAMPLES ANALYSED (SEE TABLES).

L 856 was taken at the top of the cliff, 200 ft. above the Tomahawk Beach, in a discontinuous salt-plant association, consisting of patches of *Chenopodium glaucum*, *Sonchus*, and *Senecio lautus*. This association occupies a strip some yards wide from the edge of the cliff, and the sample was taken in this area, the following sample (L 858) being taken in the adjoining area, which was grassed with rye-grass. The difference between the ease with which the salty area and the difficulty with which the grassed area was sampled was great. The sampler was only with much difficulty inserted into the latter soil. These fine sandy loams are remarkable for the high amount of available and total potash they contain. It will be seen that in the subsoils of these samples the lime-magnesia ratio is abnormal, there being more magnesia than lime extracted by the citric-acid method, while in the surface soils the proportion of each element is about the same. It is probable that such magnesia owes its origin to the sea-water blown inland as spray. The writer considers that the proportion of citric-acid-soluble magnesia present in arable soils should not exceed that of the lime. It will be noted that the available phosphate is present in larger amounts in the soil (L 856) near the cliff than in the soil (L 858) farther away. These soils are derived from a volcanic rock, trachyte, which underlies them, according to Dr. Marshall (1906). Trachyte contains a large amount of silica, potash, and soda, whereas basalt contains much less silica and more lime, iron, and magnesia.

L 860/1 and L 864/5 are coarse sandy soils, the dune-sands of the coast wind-carried to their present situation some distance from the seashore. The first soil and its subsoil (860/1) differ from the next (864/5) in that there are a comparatively recent dune-sand near sea-level, whereas the latter is from more ancient dune near the top of Sandymount, about 1,000 ft. elevation. The recent dune is very high in available phosphate, and is also high in potash. The ancient dune, while still fairly high in phosphate, has a subsoil which is decidedly deficient in total phosphate. The richness of the wind-blown sands of this district in mineral plant-food shows that the soils only require

* See K 2709, fine sandy loam, in the annual report of the Dominion Laboratory, 1909 (page 54). K 2708, loam, and L 50 and 51, fine sandy loams (referred to in the same report), are also from the same locality, but do not exhibit the same excellence in chemical composition.

SOILS OF OTAGO PENINSULA.—CHEMICAL ANALYSES. (Results, except *, are percentages on soil dried at 100° C.)

Laboratory No.	Locality.	Volatile Matter.		Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method; Hall's Modification ("Available" Plant-food).				Hydrochloric-acid Extract ("Total" Plant-food).			
		* At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.
L 856	Tomahawk Head	4·44	10·13	0·238	0·110	0·104	0·064	0·022	0·94	1·11	0·55	0·18
L 857	Subsoil of 856	4·68	7·30	0·150	0·083	0·109	0·045	0·008	0·88	1·08	0·57	0·12
L 858	Tomahawk Head	2·98	8·04	0·202	0·082	0·079	0·043	0·008	0·89	0·64	0·60	0·07
L 859	Subsoil of 858	2·70	5·51	0·095	0·052	0·066	0·038	0·005	0·86	0·70	0·59	0·03
L 860	Tomahawk Beach	0·18	1·06	0·025	0·115	0·022	0·033	0·061	0·81	0·24	0·13	0·14
L 861	Subsoil of 860	0·12	0·64	0·014	0·092	0·020	0·037	0·058	0·70	0·21	0·12	0·09
L 862	In virgin forest	7·70	25·01	0·516	0·157	0·102	0·039	0·024	0·50	0·65	0·29	0·11
L 863	Subsoil of 862	6·90	12·69	0·210	0·056	0·057	0·036	0·011	0·29	0·72	0·25	0·10
L 864	Sandymount	0·48	1·91	0·050	0·062	0·025	0·026	0·022	0·44	0·21	0·09	0·08
L 865	Subsoil of 864	0·48	1·55	0·039	0·068	0·033	0·021	0·026	0·46	0·22	0·08	0·03
L 866	Harbour Cone	3·92	12·59	0·338	0·174	0·077	0·070	0·063	0·84	0·50	0·68	0·15
L 867	Subsoil of 866	2·86	9·63	0·167	0·080	0·051	0·055	0·019	0·72	0·52	0·70	0·06
L 868	Harbour Cone (foot)	6·48	18·03	0·614	0·151	0·200	0·173	0·020	0·74	0·61	0·57	0·18
L 869	Subsoil of 868	3·20	8·14	0·209	0·118	0·140	0·193	0·021	0·92	0·62	0·45	0·11

MECHANICAL ANALYSES. (Results are percentages on air-dried soil.)

Lab. No.	Description of Soil. (Classification of United States Department of Agriculture modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.							Stones and Gravel
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture and Loss on Ignition.	
L 856	Fine sandy loam	0·2	8·6	21·1	28·7	13·6	14·9	13·8	Nil.
L 857	,, ..	Nil	9·4	21·4	28·4	10·1	20·7	11·6	,,
L 858	,, ..	,,	9·8	22·4	31·4	10·3	17·4	10·8	,,
L 859	,, ..	,,	5·6	24·9	29·1	10·1	23·3	8·1	,,
L 860	Coarse sand	,,	82·8	14·5	0·5	0·4	Nil	1·3	,,
L 861	,, ..	,,	80·9	16·9	0·4	0·3	,,	0·8	Trace.
L 862	Silt loam	,,	2·7	9·4	23·3	13·7	21·7	30·7	,,
L 863	,, ...	,,	3·9	11·9	24·3	15·8	28·1	18·7	Nil.
L 864	Coarse sand	,,	84·3	11·4	1·1	0·3	Nil	2·4	Trace.
L 865	,, ...	,,	85·5	10·5	1·1	0·5	,,	2·0	Nil.
L 866	Fine sandy loam ..	,,	1·5	18·3	37·6	11·3	16·7	16·0	Trace.
L 867	,, ..	,,	0·5	24·3	31·6	12·4	18·2	12·1	Nil.
L 868	Silt loam	,,	2·6	9·3	38·1	13·3	11·2	23·3	Trace.
L 869	Fine sandy loam ..	,,	5·5	31·6	33·2	8·2	10·4	11·1	Nil.

fixing and reclaiming in such a way with a plant covering that, when sufficient organic matter has been introduced, suitable grasses may be planted, and thus finally a permanent sward be established. An active foresting policy might prove the first stage to the economic reclamation of the most intractable of the sands. All the elements except nitrogen are present in good proportions for the growth of ordinary farm-crops suitable for light sandy country. Nitrogenized organic matter could be accumulated in the soil by foresting the area or by growing suitable plants, such as lupins, &c. One would think that pine plantations would be a great asset to this thickly settled district for the timber produced as well as for the beneficial effect on the soil.

L 862/3, 866/7, and 868/9 represent the type of soil which is the mainstay of the farmer in all countries—the loams.

L 862/3 were collected on the upper road of the peninsula, at an altitude of 500 ft., in the remains of forest consisting of rimu, totara, mahoe, fuchsia, broadleaf, bramble (*Rubus australis*), elderberry, coprosma (several species), *Panax Colensoi*, *Drimys*, and *Muehlenbeckia australis*.

L 866/7 were collected on the slopes of Harbour Cone in rye-grass, clover, and timothy pasture. This soil has an abnormally high phosphate content. Silt is the largest fraction, therefore the soil should possess a sufficient but not too great power of retaining water. The fine silt is lower than the clay, which is present in satisfactory amount. As there is a considerable amount of fine sand, the absence of coarse sand is no disadvantage. One would predict high fertility for this soil from a consideration of its physical and chemical characters and climate, and a profitable return to its owner owing to the proximity of the locality to the market.

L 868/9 were taken in a salt-marsh plant association at the foot of Harbour Cone, on the shores of Hooper's Inlet. The soil is a silt loam resting on a fine sandy loam, and is subject to inundation by the brackish water of the inlet. The abnormally high potash content and the unbalanced lime-magnesia ratio are characteristic of salty soils, as is also the good amount of phosphate present. The proportion of silt is rather too high, but this might be remedied by bringing up some of the sandier subsoil when these silty soils come to be reclaimed.

Nosema apis, the protozoon occupying the epithelial cells of the chyle stomach of bees, has been traced to many parts of the Dominion, and it would appear to be almost universal. Its presence in bees, however, cannot be associated with any acute disorder in New Zealand, though minor troubles have been occasionally found present in bees harbouring the organism.

Phosphates in New Zealand.—A new locality for the occurrence of phosphate rock in New Zealand apparently exists in the North Auckland district. Mr. H. Parsons, of Rawene, Hokianga, forwarded to the Department's Chemical Laboratory last year a specimen of rock which contained 11·12 per cent. phosphoric acid, equal to 24·4 per cent. tricalcic phosphate. A specimen of greensand, received from Mr. L. W. Kempthorne, of St. Andrew's, near Timaru, was found to contain 4·1 per cent. phosphoric acid, equal to 8·95 per cent. tricalcic phosphate.

FARMERS' FIELD COMPETITIONS, 1922-23 SEASON.

TARANAKI, WANGANUI, AND FEILDING DISTRICTS.

J. W. DEEM, Fields Instructor.

THESE competitions have been continued as in previous years, fourteen localities taking part in 1922–23. The wet season was rather detrimental to good cultivation and heavy yields, conditions being so bad in some parts that no entries were made. After eliminating all failures, the following crops were judged: Mangolds, 119; carrots, 64; swedes, 63; soft turnips, 20; lucerne, 71; and maize, 5: a total of 342. These figures mark a net increase of eleven over those of the previous year. Soft turnips fell off in entries, while lucerne showed a considerable increase.

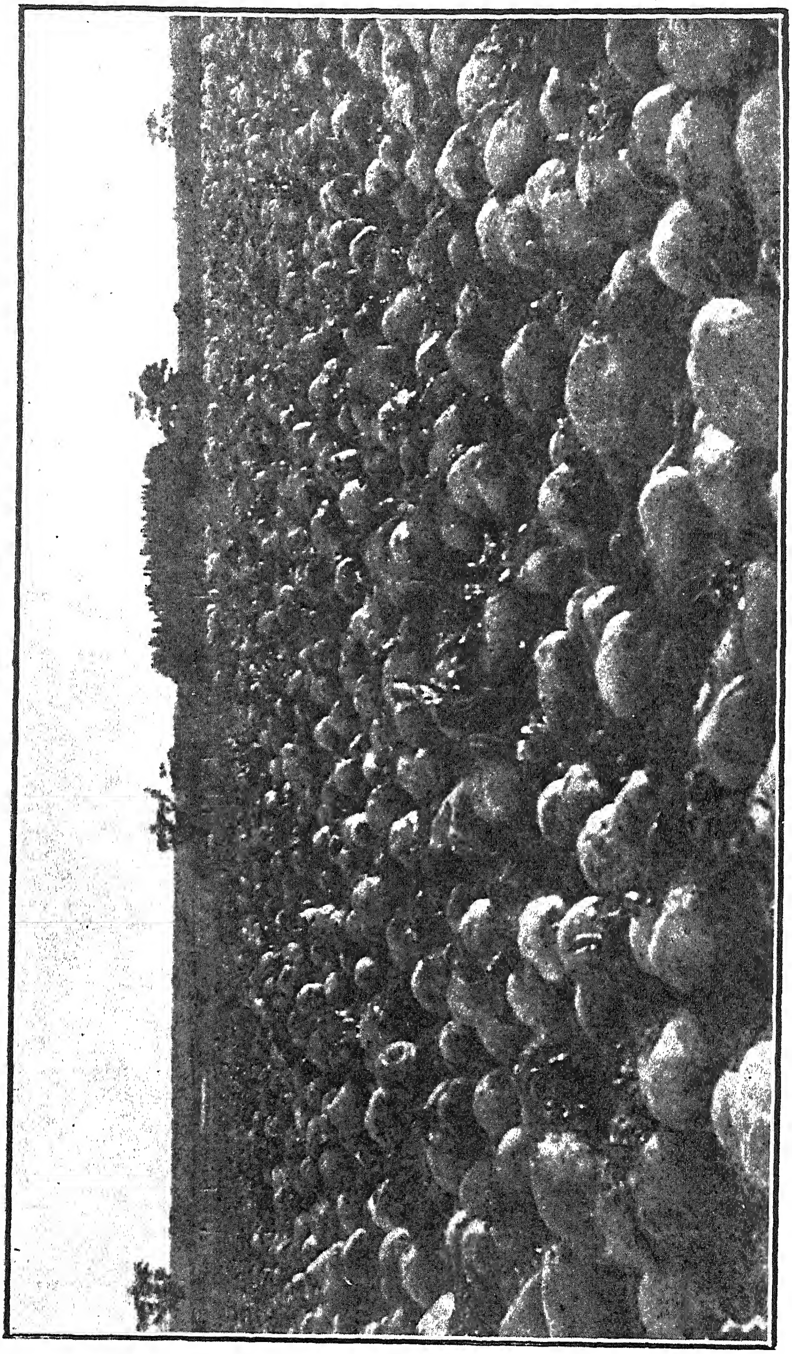
All these crops were judged by Instructors Glasson, Schwass, and the writer. Small competitions were held in a few other centres, and the crops judged by local judges. In most districts, as in previous years, farmers turned out in large numbers for the judgings, and took a keen interest in the proceedings. In some of the more active centres the number of young farmers who attend is very gratifying, and it is this type of enthusiast that is going to derive the greatest benefit from the competitions.

In localities where the competitions have been going longest the averages of the crops continue to increase, and the better cultivation and general care are very pleasing. Taking, for example, places like Otakeho and Maxwelltown, the former, with nine crops of mangolds, had an average of 68 tons 8 cwt. per acre, and the latter, with seventeen crops, the even better average of 69 tons 18 cwt. To a lover of a good and well-cared-for crop a day spent at the judging in either of these localities was very enjoyable.

MANGOLDS.

Mr. Charles Willis, of Matapu, won the championship for south Taranaki with a crop of 84 tons 6 cwt. per acre—total points, 182½. Last year's winner, Mr. J. Dakers, of Manaia, was second with 182 points—a very close contest. In the Wanganui district Mr. H. Birch, of Maxwelltown, won again this year with a crop of 93 tons 5 cwt. per acre, beating his previous year's record by 5¼ tons. This was an exceptionally fine crop, as shown in the accompanying photograph, and reflected great credit on the grower. In the Feilding district the best crop, 77 tons 1 cwt. per acre, was grown by Mr. W. E. Johnston, of Te Arakura. These competitors also won the Sutton Cups for the best crop of mangolds in their respective districts.

It is very pleasing to record the interest Messrs. Sutton and Sons, through their New Zealand agents, Messrs. J. G. Ward and Co., continue to take in these competitions. In addition to the three handsome cups presented last year, they have promised a fourth for the Rongotea district. These trophies have assisted greatly in stimulating interest in the movement.



MR. H. BIRCH'S MANGOLD CROP, MAXWELLTOWN.

Area, 4 acres; yield, 93 tons 5 cwt. per acre. Winner of the Sutton Cup for Wanganui district.

Prizewinner. Yellow Globe, White Sugar, and Jersey Queen are the varieties that show up best in the competitions. From an analysis of the fourteen competitions it is found that Prizewinner constituted 58 per cent. of the crops judged, and won ten competitions and all the championships; White Sugar constituted 9 per cent. and won two competitions, and Jersey Queen 6 per cent. and two competitions; while Long Red constituted 8 per cent., but again failed to win a competition. The remaining 19 per cent. was made up of mixed varieties and a few sorts not grown extensively.

Over the whole of the competitions Prizewinner averaged 54 tons 17 cwt. per acre, White Sugar 57 tons 18 cwt., Jersey Queen 54 tons 1 cwt., and Long Red 43 tons 9 cwt. In the Feilding district Prizewinner was grown almost exclusively, and there was only one crop of White Sugar in that locality. If we exclude the Feilding figures the average weight per acre of Prizewinner is 58 tons 13 cwt.

The mangolds were grown in various-width drills, ranging from 14 in. to 30 in. Summarizing the results, 9 per cent. of the crops were grown in 14 in. drills and secured two competitions, 15 per cent. in 21 in. drills and won one competition, 14 per cent. in 24 in. drills, 8 per cent. in 26 in. drills, and 42 per cent. in 28 in. drills. All the last-mentioned three won three competitions. One crop in 18 in. drills and one in 27 in. drills each won a competition.

These figures confirm the findings of previous years—namely, that on the average the best mangold crops are grown in fairly wide drills, where the cultivation can be done thoroughly by means of the horse-hoe.

The following table gives the average weights per acre of mangold crops in the Taranaki, Wanganui, and Feilding districts for the past three seasons:—

	1920–21.		1921–22.		1922–23.	
	Tons	cwt.	Tons	cwt.	Tons	cwt.
Taranaki	51	9	56	18	54	19
Wanganui	44	1	56	18	65	19
Feilding	33	19	46	10	42	15

The averages over the three districts combined were—1920–21, 45 tons 8 cwt.; 1921–22, 55 tons 1 cwt.; 1922–23, 53 tons 12 cwt.

As in previous years, various manures have been used, and it is difficult to fix on any particular one as best. The heaviest crop in Taranaki, 84 tons 5 cwt. per acre, was grown with 4 cwt. of special mangold-manure; in Wanganui district, 93 tons 5 cwt., with half superphosphate and half bone-meal at 4 cwt. (plus salt at 5 cwt.) per acre; and the best crop in the Feilding district with basic super at 4 cwt. per acre. The main points appear to be a liberal dressing of phosphatic manure (a fair portion of which is readily available), some salt or kainit, and plenty of good cultivation.

CARROTS.

The areas of carrots in the competitions were larger than in previous years, indicating that this root is increasing in favour each year for feeding cattle and sheep.

Matchless White is by far the favourite variety grown, with Sinclair Champion next. Of the total number of crops judged,

53 per cent. were Matchless White and won seven competitions, 22 per cent. Sinclair Champion and won one competition, 5 per cent. White Belgian and won two competitions. The remaining 20 per cent. consisted mainly of mixed varieties and secured only one competition.

Over all the competitions Matchless White gave an average yield per acre of 42 tons 15 cwt., Sinclair Champion an average of 38 tons 4 cwt., and White Belgian an average of 44 tons 8 cwt. A few Long Reds were grown, but they are too deep-rooted. The heaviest crop of carrots was 62 tons 3 cwt., against 64 tons 9 cwt. per acre last year. The average for all the crops in the competitions this year was 41 tons 4 cwt., against 40 tons 1 cwt. last year.

The method of sowing varies. Summarizing the results, it is found that 34 per cent. of the crops were grown in 14 in. drills, and averaged 43 tons 10 cwt. per acre, and won five competitions; 22 per cent. in 21 in. drills averaged 45 tons 14 cwt., and won four competitions; 30 per cent. in 28 in. drills averaged 34 tons 3 cwt., and won one competition. The remaining 14 per cent. were in various-width drills. A crop in 26 in. drills won one competition.

Manures used were very varied, and most mixtures applied at 3 cwt. to 4 cwt. per acre appear to have given good results. In seeding, from 1 lb. to 1½ lb. per acre gave the best returns.

SWEDES.

These, as usual, were mostly sown on the flat, either through every coulter or every second coulter of the drill, only a few farmers so far using the ridger. They did not show so much disease as last year. The main varieties grown were Superlative, Magnum Bonum, Masterpiece, Grandmaster, and a few crops of Vilmorin's White Purple-top. The Superlative, as usual, grew heavy crops but suffered most from dry-rot, Magnum Bonum and Masterpiece being also badly affected. Grandmaster, although showing a fair amount of dry-rot in some places, furnished a number of very fine, sound crops. Vilmorin's White Purple-top gave heavy weighings, and was only very slightly affected with dry-rot. Unfortunately, this swede forked badly and grew very deeply in the ground, which is objectionable both for pulling and feeding-out, but even with these faults it would be largely grown if seed were available. Most of the winning crops had from 2 cwt. to 3 cwt. of manure per acre—all sorts of fertilizers being used. While no particular mixture stands out, the best results were obtained from mixtures containing about half superphosphate in conjunction with a slower-acting phosphate like bone-meal, Ephos, Nauru, or basic slag. Basic super also gave good results. The addition of nitrogen in any form does not appear beneficial. The crops averaged for Taranaki 35 tons 9 cwt., and for Feilding 29 tons 11 cwt., or an average over all of 34 tons 7 cwt., against 30 tons 4 cwt. last year.

LUCERNE.

The lucerne competitions are divided into three classes—namely, crops under twelve months old, crops over twelve months and under two years, and crops over two years old. By this arrangement

interested farmers who go round at judging-time are enabled to follow the respective crops from year to year and mark their progress and treatment. Lucerne-judging days are very popular. In going round year after year it is noticeable that most of the competitors are extending their areas. Drilling from 15 lb. to 18 lb. of Marlborough seed, with from 2 cwt. to 3 cwt. of a phosphatic manure—super or basic slag for preference—continues to give the best results, the land having been previously limed at from 8 cwt. to 20 cwt. per acre.

GENERAL.

At the Hawera Winter Show exhibits from the first, second, and third crops of most of the competitions were staged. These exhibits carried cards setting out full particulars of the variety, date sown, manure used, and general cultural methods. It made a very fine and instructive display.

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

V. THE KINGFISHER, THE CUCKOOS, AND THE PARROTS.

J. G. MYERS, B.Sc., F.E.S., R.A.O.U., and ESMOND ATKINSON,
Biological Laboratory, Wellington.

THROUGHOUT this series of articles it has been the aim of the writers to state facts and nothing but facts. The agriculturist is often forced to realize the damage inflicted on his interests by birds, and it is only natural that this should be uppermost in his mind when he thinks of birds. It is the more natural since the good services of birds are among the silent processes of nature, which do not become obvious until naturalistic studies are bent upon them. The enthusiastic bird-lover, on the other hand, is not often concerned directly with agricultural interests; he may be carried away entirely by his strong perception of the good birds do, and, as a result, the cause of the birds themselves is his first object. Shelford goes so far as to state that "When one comes to love an animal or a group of animals he is in no position to draw scientific conclusions regarding it"; but to the present writers this seems an extreme view. The aim of these articles is to present the exact scientific standpoint, and to preserve a just balance between the prejudices of the farmer and the enthusiastic eulogium of the bird-lover. That they have been at least partially successful in this endeavour is indicated by accusations now levelled against them with considerable frequency of, on the one hand, making out too good a case for the birds, and, on the other, of making it not good enough. In no case is this balance more necessary than in that of the kingfisher—the next bird on the list.

THE KINGFISHER (SAUROPATIS SANCTUS VIG. AND HORS.).

There is probably no need to describe to New Zealand readers either the form of the kingfisher, with its long sharply-pointed beak,

and beautiful blue and green upper parts relieved by a buff or even yellow breast, or its nest in a clay bank or decaying tree-stump, containing pure-white roundish eggs. The numbers of kingfishers vary extremely with the locality and with the season. In the southern portions of the North Island, for example, there are many districts where the kingfisher may be reckoned a rare bird. In the North Auckland Peninsula, however, it is one of the commonest of birds, and it is there, consequently, that it enters into the closest relations with agriculture, and there, moreover, that a request has been recently made to deprive it of all protection, in order that its numbers may be thinned.

The kingfisher is extremely plentiful also in the actual vicinity of Auckland, whence the writers have had the good fortune to receive the following authoritative notes by Mr. R. A. Falla, R.A.O.U., than whom there is in New Zealand no more reliable ornithologist :—

Notes on the Food of the New Zealand Kingfisher.

Of the widely distributed family of birds known collectively as kingfishers only one small subfamily is structurally adapted for living exclusively on a diet of fish. These, represented by the common kingfisher of Europe, have a narrow spear-like bill, compressed and grooved to give it cleaving-power, and the very short tail common to most diving-birds. The other extreme is represented by the laughing-jackass type, which has a heavy bill broadened for holding small reptiles, and strengthened for crushing.

The New Zealand kingfisher is structurally nearer to the latter type, and one would expect to find his diet regulated accordingly. This seems to be the case. Although he has just sufficient resemblance to his English relative to enable him to fish rather clumsily when opportunity offers, his regular diet consists of almost every kind of living creature except fish. The following notes refer to the Auckland District, where the kingfisher is probably more common than anywhere else in New Zealand, and are based on close observation at all seasons of the year over a period of eight years :—

Crabs : As probably 90 per cent. of the kingfishers in the district live on the banks of tidal creeks and estuaries, where they appear to feed exclusively on small crabs, these form the most important item as far as this district is concerned. The concrete casing of the drain which runs across Hobson Bay is often dotted for its whole length of over a mile with the pellets of indigestible parts which the bird voids from its crop. One day's collection of these pellets contained the remains of over a thousand small crabs.

Crickets : The inland birds are mainly insectivorous. They usually stay the whole year round in one locality, and feed on whatever insect is most abundant at the time (and suitable for food). In the spring of 1917 the kingfishers at one end of the Auckland Domain appeared to be living on crickets, judging from the few pellets found (they are more difficult to find among trees and vegetation).

Other insects : The birds under observation in the Domain, as noted above, varied their menu at different seasons. During some months they frequently hunted in the vegetable-gardens, but I could not always discover what insects they were taking. Ants often appeared to be the victims. They seem to prefer larger insects when obtainable, and are frequently seen with dragon-flies and cicadas. Soft-bodied larvæ were seen being given to the nestlings on several occasions.

Worms : Kingfishers have a very quick eye for the slightest appearance of an earthworm, but do not seem to get many.

Mice : I have seen a bird with a well-filled neck and a mouse-tail hanging out of its bill.

Lizards : My observations here include only half a dozen cases of kingfishers being seen with lizards, although Guthrie-Smith states that at certain times lizards form nearly all their diet.

Small birds: I have seen kingfishers once or twice battering white-eyes' bodies, which presumably they swallowed later.

Fish: On the only occasion on which I saw a kingfisher actually engaged in fishing the bird made an awkward dive into a pool (flopped in) and fluttered out without anything visible in its beak. It may even have been after fresh-water insects or tadpoles.

The habit of throwing up pellets containing all the indigestible portions of the prey—shells, fur, feathers—is shared also by the owls. It obviously offers a striking opportunity to gain an accurate knowledge of the birds' diet, and renders possible the comprehensive survey which Mr. Falla has supplied. It should be remembered that this account claims to deal with the kingfisher's habits in one district only. Probably in certain other districts fish form a larger proportion of the diet than in the vicinity of Auckland; but this is unquestionably not the case in the North Auckland Peninsula as a whole. There the chief food consists of crabs, crickets (*Gryllus servillei* Sauss.), long-horned grasshoppers (*Xiphidium semivittatum* Walk.), and probably locusts (*Locusta migratoria* Linn.). The luxuriant summer growth of paspalum harbours immense numbers of crickets and grasshoppers. Crickets constitute a veritable pest, particularly abundant on recent bush-burns, where much of the young grass is destroyed by them and establishment frequently delayed. This large black cricket is believed to have been introduced from Australia. In the North Auckland district it has increased to a phenomenal extent, so that it is no uncommon occurrence to surprise as many as thirty or forty beneath every dry cake of cow-dung turned over in a pasture. Cases are known of large holes being eaten by these voracious insects into coats laid temporarily on the grass. The writers believe that the unusually large numbers of kingfishers in the peninsula are due to the tremendous access of food supplied by the crickets. It is an incontrovertible maxim of economic ornithology that, within wide limits, birds eat the food which is most easily obtained and most abundant. Unquestionably the most plentiful kingfisher-food in the north of New Zealand is formed by the seething grasshopper and cricket population of the northern grasslands.

In Australia, where an almost identical form of our species is known as the "forest kingfisher"—a name in itself significant—the stomachs of those examined by Cleland and his associates contained fresh-water crayfish, weevils and other beetles, and locusts and grasshoppers. In the summing up it is described as a useful insectivorous bird.

The English kingfisher, which gave its name to the whole family, is, as Mr. Falla points out, structurally fitted to live almost exclusively on fish, yet it is rigorously protected in England. When the early naturalists found in other lands birds of the same family living entirely on land-animals, dwelling in the forest miles from water, they realized the inappropriate nature of the name "kingfisher," and suggested instead that of "kinghunter." The latter title should rightly be applied to the New Zealand species; but so firmly fixed in the language is the former name that change is almost impossible. In the attempted persecution of this bird as an allegedly serious enemy of trout the writers are unable to see any other justification than that afforded by the proverb "Give a dog a bad name and hang him."

THE LONG-TAILED CUCKOO (URODYNAMIS TAITENSIS SPARR.).

The long-tailed cuckoo, or koheperoa, is one of New Zealand's three regular migrants, breeding here in summer and spending the winter in the tropical islands of the Pacific—Fiji, Samoa, the Solomons, the Marquesas, and other groups—thus accomplishing twice yearly a journey of over a thousand miles. Its plumage, barred with dark brown, and its excessively long tail, render it quite unmistakable. Fulton has published a very interesting account of this bird, from which much of the following information has been gathered. His paper is so exhaustive that the work of the present writers has been able to add very little to it.

The most interesting feature of this, as of most other cuckoos, is its well-known habit of delegating its parental duties to other and usually smaller birds by depositing its eggs in their nests. The disproportionately large nestling is assiduously fed and reared to maturity by the devoted foster-parent. Having regard to the interest of this habit, and of its familiarity to all, it is truly remarkable that so little is known as to the foster-parents of the long-tailed cuckoo and as to the method of depositing its eggs in strange nests. Young cuckoos of this species have been found in nests of the yellow-breasted tit, the whitehead, and the yellowhead. The grey warbler, South Island robin, brown creeper, tui, white-eye, bell-bird, and pigeon are all—on more or less circumstantial evidence—said to act on occasion as foster-parents. Further observations on these points would be of the greatest interest.

The habits of the koheperoa, largely on account of its noiseless flight and semi-nocturnal activity, are shrouded to a considerable extent in mystery. One point, though, is clear — the unsavoury reputation borne by cuckoos the world over as stealers of birds' eggs and killers of young birds is entirely merited by our long-tailed cuckoo. The detailed researches of Fulton indicate, however, that most of its energies in these directions are bent not on the indigenous and insectivorous bush-birds, but on the introduced small birds which in many localities form a pest of the cultivator. A few quotations will make this clear. "I have seen a cuckoo repeatedly with young birds in its bill, and have examined the nest after the cuckoo has been at them, and have found nothing but the shell of the egg left. It chiefly robs sparrows' nests. . . . I have seen one go into a red-pine tree and take from a hole in the trunk a young sparrow, fly into the scrub with it, and in a short time return and repeat the performance with another nestling." Other birds or their eggs taken by the long-tailed cuckoo include introduced thrush, linnet, bell-bird, brown creeper, and introduced blackbird. Fulton states further: "There are very few instances of egg-robbing recorded, and those only since the introduction of English birds, and, as the natural food of the cuckoo has become scarcer, the bird has acquired the habit of helping itself from the nests of those who have largely been responsible for the diminished food-supply. Many of my correspondents state that the cuckoo is now more common than it used to be, and attribute this to the abundance of imported birds. . . . Imported birds seem to live and breed in the vicinity of cultivated country, consequently near townships their nests and young are much more easily found and are much more numerous than

the native ones, and it seems to me that the cuckoo is living on the eggs and young of these birds; and, as they are more numerous near dwellings and gardens, the cuckoo also comes closer, and is more in evidence than it was. . . . I think that if the matter is gone into it will be found that the cuckoo does the best he can towards combating the sparrow plague."

The long-tailed cuckoo, then, must be considered an enemy of the introduced small birds, against which have been introduced barn-owls and more recently the little owl. The whole question of these introduced small birds will be dealt with fully in the later articles of this series. At the present time it must suffice to state that even if certain species of them are doing more good than harm, many of them are such that an all-round reduction of their numbers would render them less liable to attack crops, and would thereby increase the percentage of good services rendered by them. Such are probably the house-sparrow, the yellowhammer, the skylark, the starling, the mina, and the rook.

THE SHINING CUCKOO (LAMPROCOCCYX LUCIDUS GM.).

It is probable that many people know the characteristic whistle of the pipiwharauroa and are yet entirely unfamiliar with the appearance of the vocalist. This little bird, with its distinctly barred breast and beautiful bronze-green back, is another of our few migrating birds. In its case, however, according to the recent researches of Mathews and Iredale, the winter home is quite unknown. Formerly it was believed to winter in northern Australia, but now (although proof is lacking) it appears that New Guinea is more probable.

The most frequent foster-parent of the shining cuckoo, or "whistler," is the grey warbler; but cases in which the white-eye, the yellow-breasted tit, and even the house-sparrow acted in this capacity have been recorded. In the case of the grey warbler, with its covered-in nest (see *Journal* for August last, p. 80), it would seem almost impossible that the cuckoo can enter and actually lay her eggs in the nest-cavity. It seems almost certain that she must lay her egg upon the ground and deposit it in the nest with her bill. In this connection Mr. P. Keegan, of Whakatane, writes, under date 27th September, 1922: 'When a lad on Banks Peninsula I often watched the shining cuckoo placing an egg in the grey warbler's nest. A cuckoo would approach the nest, and the two warblers would make a fierce attack on it. The cuckoo would lure them away some distance. Then its mate would dash in with an egg in its beak and place it in the nest." Other foster-parents mentioned by Fulton are fantails, robins, tomtits, blackbirds, and sparrows.

The shining cuckoo shares with the well-known English cuckoo and other typical members of the family the ability to eat hairy caterpillars, which are usually believed to be distasteful to other birds. It is true that McAtee considers that hairy caterpillars in general are by no means so objectionable to birds as is usually supposed, and he instances the English house-sparrow destroying large members of the white-marked tussock-moth caterpillars (*Hemerocampa leucostigma* S. and A.); but there cannot be the slightest doubt that cuckoos are better adapted than other birds to this diet, and in actual fact they do make a specialty of hairy larvæ. The same author describes the yellow-

billed cuckoo (*Coccyzus americanus*) and its method of treating the hairy tent-caterpillars (*Clisiocampa americana*). It squeezed out the juices and dropped the hairy skin to the ground. Mr. W. W. Smith, in this country, has watched our shining cuckoos feeding on the dark extremely hairy caterpillars of the common black-and-white moth (*Deilemera annulata* Boisd.). It proceeded in exactly the same way as its American cousin, pressing the larvæ between its mandibles and rejecting the empty skins. Among other more or less hairy caterpillars eaten by the shining cuckoo may be mentioned those of the "kowhai-moth," which Mr. G. V. Hudson considers is almost certainly *Mecyna maorialis* Felder.

So far as New Zealand conditions are concerned, it seems clear that the shining cuckoo is practically purely insectivorous, and might therefore have been granted notice in our preceding article. Fulton, however, believes that at times it feeds on the eggs of small birds—at least one of his correspondents having seen it in the act. The same writer mentions moths, daddy-long-legs (Tipulidae), caterpillars, flies, gnats, and "fruit-slugs" as appearing in the cuckoo's menu. He even quotes a correspondent who accused the shining cuckoo of eating Burbank plums; but this is, on the face of it, so utterly at variance with the general food habits of the cuckoo family that it needs confirmation before it can be accepted as true. With regard to the highly injurious fruit-slug, the larva of the pear and cherry sawfly (*Eriocampoides limacina*), the writers know of several cases in which the shining cuckoo has eaten very large numbers, and there can be no doubt that in this direction it performs a good service for the orchardist. Cleland and his associates found a closely related Australian cuckoo with no fewer than twenty-five cutworm larvæ in its stomach. They further state, "All cuckoos are evidently highly useful insectivorous birds, feeding especially on various caterpillars."

THE PARROTS.

The parrots of New Zealand include the kaka, the kea, four species of parrakeets, and the now extremely rare kakapo. Of these the kea will form the subject of an entire article at a later date; while the others are among the most exclusively forest-dwelling species of the indigenous birds, and as such have been briefly discussed in the second part of this series. The kaka, the parrakeets, and particularly the kakapo have all decreased to a very great extent under the adverse influence of bush-clearing and settlement, which deprived them of the forest habitat to which they were pre-eminently adapted, and they found it impossible to subsist in settled districts. It is true that the early colonists of the South Island saw vast irruptions both of kakas and of parrakeets, which descended in countless hordes on the cultivated areas, committed extensive depredations on various crops, and proved for a limited period a pest of the greatest magnitude; but, in spite of our ignorance of the abnormal conditions which produced these vast immigrations, it can safely be asserted that such are never likely to occur again.

The kakapo (*Strigops habroptilus* Gray) is now so rare that it need not long detain us here. As one of those especially interesting and anomalous flightless birds of which New Zealand possessed such a

unique assemblage it was one of the first to suffer from the attacks of the various predaceous animals and vermin introduced by Europeans. Its diet is almost entirely vegetarian, consisting largely of grass, moss, and similar vegetation, which it grazes almost like a mammal and of which it devours large quantities.

The Kaka (Nestor meridionalis *Gm.*).

The kaka, with its almost wholly olive-brown plumage, the bright red of the under-surface of the wings when seen in flight, and the grey crown which inspired the founder of the genus to which it belongs to dedicate it to the venerable Grecian orator, is one of the most easily recognized birds of the forest. This is the more so since its clamorous notes are not easily mistaken. The white eggs are laid on the more or less bare floor of a hole in a tree, often at or below ground-level in an entirely hollow trunk, the entrance being a comparatively small hole high up the tree.

The feeding-habits of the kaka may be conveniently discussed under the three heads of berry-eating, honey-eating, and insect-eating.

With regard to the first, the efficiency of the kaka as a seed-disperser must be impaired by its habit of breaking up with its powerful mandibles the larger seeds on which it feeds, and in this direction it would perform much less service than that prince of seed-distributors the pigeon. It must be emphasized, however, that this point should be investigated, as at present practically no data are available regarding the treatment of the different forest-fruit kernels by the kaka and by the parrakeets. It is a matter in which the closest field observations are necessary.

The tongue of the kaka is modified in a very remarkable manner as an organ for extracting the nectar from flowers. Of the latter the rata (*Metrosideros* spp.) is a favourite. The dispersal of the rata-seeds is not easily explained; they appear too heavy to be blown far by the wind, while juicy flesh which would be attractive to birds is lacking. Guppy has therefore suggested that the seeds may become to some extent entangled in the feathers of the kaka when these heavy and active birds are busy in clamorous activity among the later blossoms of the rata.

As an insect-hunter the kaka has few rivals. Buller graphically described these birds "climbing up the rough vine-clad boles of the trees, freely using their powerful mandibles, and assuming every variety of attitude, or diligently tearing open the dead roots of the close epiphytic vegetation in their eager search for insects and their larvæ."

In summing up the activities of the kaka we cannot do better than use the words of the same ornithologist (Buller): "It is strictly arboreal in its habits, and subsists to a large extent on insects and their larvæ, so that it is probably one of our most useful species. Where they exist in large numbers they must act very beneficially on the timber forests; for in the dominion of nature important results are often produced by apparently trivial agencies. Like all the honey-eaters, while supplying their own wants they do good service with their brush tongues by fertilizing the blossoms of various trees, and thus assisting in their propagation; while, on the other hand, the diligent

search they prosecute for insects and grubs, and the countless numbers daily consumed by each individual, must materially affect the economy of the native woods."

The Parrakeets.

Of the four species of these beautiful birds found in the New Zealand region, one is confined to Antipodes Island, while a second, the orange-fronted parrakeet, is apparently practically extinct. The remaining two—the red-fronted (*Cyanoramphus novaezealandiae* Sparr.) and the yellow-fronted (*C. auriceps* Kuhl)—are widely distributed over both Islands of the mainland where suitable areas of bush are to be found. Both birds are almost wholly green in colour, with a red forehead, but the crown of the head of the red-fronted is crimson, while that of its rather smaller relative is yellow. Both lay their roundish white eggs in the holes of trees.

Of their feeding-habits little of a detailed nature is known. They appear to be rather more vegetarian in their tastes than the kaka, and to subsist very largely on berries. The black juicy fruit of the tutu (*Coriaria sarmentosa*) is much relished. It is said that the Antipodes Island species feeds largely on the seeds of the piripiri, hutiwai, or "biddy-bid" (*Acaena* sp.). Reference has already been made to the vast flocks of parrakeets which visited settled areas in the early days, and from the ravages of which scarcely any kind of seeds, grain, or fruit escaped. Under such conditions the parrakeets were as great a pest as the hordes of cockatoos still are in portions of Australia; but under present conditions their numbers are so much reduced, and they are confined so entirely to the forest, that their economic importance can be considered only from the forestry viewpoint. In their present numbers they must therefore be included among the predominantly beneficial birds.

REFERENCES.

BULLER, W. (1882): Manual of the Birds of New Zealand. Wellington.

CLELAND, MAIDEN, FROGGATT, FERGUSON, AND MUSSON (1918): The Food of Australian Birds. *N.S.W. Dept. of Ag. Sci. Bull. 15.*

FULTON, R. (1904): The Koheperoa, or Koekoea, Long-tailed Cuckoo (*Urodynamis taitensis*). *Trans. N.Z. Inst.*, vol. 36, pp. 113–148. (1910): The Pipiwharauroa, or Bronze Cuckoo (*Chalcococcyx lucidus*). *Trans. N.Z. Inst.*, vol. 42, pp. 392–408.

HUTTON AND DRUMMOND (1905): Animals of New Zealand.

MCATEE, W. L. (1922): Local Suppression of Agricultural Pests by Birds. *Smithson Rept. for 1920*, pp. 411–438.

MATHEWS AND IREDALE (1913): A Reference List of the Birds of New Zealand. *Ibis*, ser. 10, vol. 1, pp. 201–263, 402–452.

SHELFORD, V. E. (1913): Animal Communities in Temperate America. Chicago.

SMITH, W. W. (1923): Feeding-habits of the Shining Cuckoo. *N.Z. Jour. Sci. & Tech.*, vol. 6, p. 61.

New Rabbit District.—The constituting of the Kiwitea Rabbit District (Wellington) for the purposes of Part III of the Rabbit Nuisance Act was gazetted on 13th September.

BACON PIGS.

SUITABLE CARCASES FOR EXPORT.

K. W. GORRINGE, Instructor in Swine-husbandry, Live-stock Division.

At the present time there is much discussion in the Dominion regarding the export of pork and bacon pigs, and the early necessity for developing operations in this direction. It is not generally understood by breeders what are the requirements of the bacon-curers, and the type, form, character, age, and degree of fatness of the bacon pig most suitable for export. If it is the aim of our producers to capture a material portion of the immense amount of money paid for pork and bacon imported into Britain yearly from other countries, then they must supply what the ultimate consumer demands, as it is unreasonable to expect the intermediate exporter to pay a first-grade price for an unsuitable carcase. There is also a tendency among exporters to rush into this business when prices are fair without due consideration as to the requirements of the British bacon-curer. The latter knows what he wants in catering for the British consumer, and is prepared to pay a good price for select bacon-type carcases.

What, then, is required in a first-grade bacon carcase? Firstly, type—great length of carcase, varying from 3 ft. 6 in. to 4 ft. 6 in. from the aitch-bone knob to neck; back fat evenly distributed, averaging 1½ in. in thickness; hams not too gross; shoulders not to be heavy; and sides a nice, even width, with underline free from "seedy cut." Secondly, quality—fat to be firm and white, and lean firm but not hard. The quality of the bacon is greatly influenced by the feed used in preparing the animal for market. The injudicious feeding of large quantities of maize or beans produces a soft carcase—in trade terms called "softs"—that is, the fat is soft, of bad colour, and of an oily nature, and the lean hard and leathery. Other factors are also responsible for a large percentage of softs—namely, unthriftiness, lack of exercise, immaturity, lack of finish, imperfect feeding, undue forcing.

Why is the "select" bacon-type pig preferred by curers to the plump, full-bodied pig of the same weight? The reasons are easily explained by comparing Figs. 1, 2, and 3, which show how pigs each weighing alive about 200 lb. may yield a product entirely different. No. 1 may be described as a select Wiltshire side. This side of bacon is in appearance almost perfect. It has the required length, so that, when the ham and shoulder are cut off, the middle cuts contain the proper length, and the rest of the side a nice balance which will cut up attractively for retailers. The fat and lean are well proportioned, with the back fat about 1½ in. in thickness, and hams and shoulders of medium weight. Contrast this with No. 2. This side if shown by itself would probably appeal to breeders as very nice-looking, but by curers and retailers it would be classed as second grade or heavy. Note the extreme shortness, heavy back fat, and the

gross form of ham and shoulder. Each of these faults would preclude it ranking on the British market as select Wiltshire bacon. Fig. 3 is about as bad a side as one could wish to see. It represents the lowest grade of bacon. The back fat is of a thickness only suitable for the heavy or sausage trade, and the thin belly renders it useless for anything but thirds, or unbranded bacon. It has also a wide ugly side, a feature shunned by all bacon-curers. These types, with two or three others more or less of a bad character, are to be found in most of our curing plants to-day, and are, with the exception of No. 1, a menace to any wide expansion of the bacon industry in New Zealand.

THREE TYPES OF BACON SIDES.

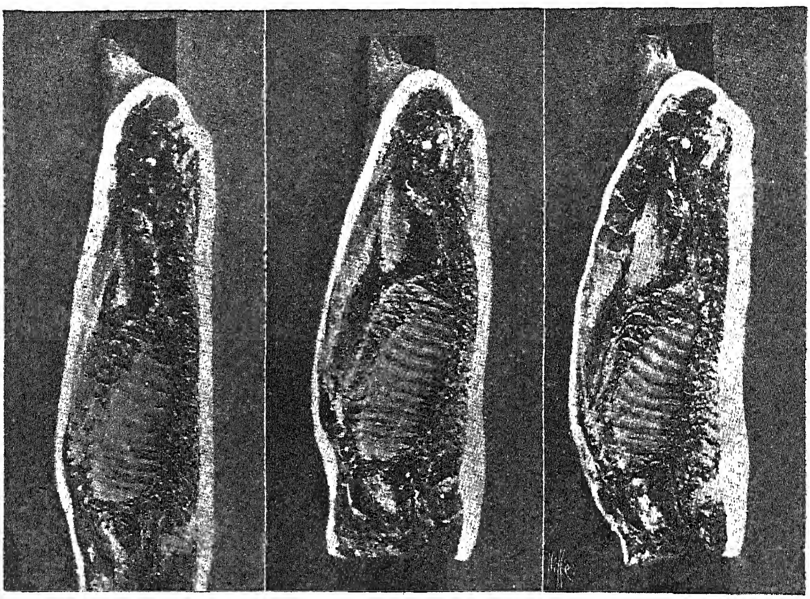


FIG. 1. FIG. 2. FIG. 3.

[*Douglas's Encyclopædia.*

The superiority of the bacon-type pig in its yield of meat over the thick fat pig was shown during a course of instruction to farmers at a Canadian curing plant. Two carcases of pigs of different grades, as exemplified by Figs. 1 and 2, were prepared for market, and each step was demonstrated to the audience. The yield in meat and waste resulted as follows :—

Live weight : Bacon type, 186 lb. ; fat type, 163 lb.

Dressed weight : Bacon type, 140 lb. ; fat type, 125 lb.

Trimmings (excluding head and feet) : Bacon type, 12 lb. ; fat type, 22½ lb. Trimmings mean the odds and ends which must be cut off hams, shoulders, and middles in order to round them off and make the meat attractive for the trade cuts. They are of small value when taken off.

The returns from these figures are instructive. The dressed-carcase returns showed $1\frac{1}{2}$ per cent. higher rate in favour of the fat type, but in every instance after the bacon type was superior. The bacon type, although a heavier pig, showed a loss of 12 lb., or 8·5 per cent., against $22\frac{1}{2}$ lb., or 18 per cent., in the fat type. The percentages in untrimmed loins were 13·5 for the bacon type and 12·8 for the fat type; trimmed loins showed 10·7 for the bacon type and 7·2 for the fat type. The experiment showed all through that the bacon type was better in its meat-yield.

The foregoing description should make it clear that any indiscriminate exporting of bacon pigs of the various types (notwithstanding that they have passed the veterinary inspection and are good weights and well conditioned) would be a very unwise policy, and unless a system of grading were adopted our producers and shippers might find themselves in a very unsatisfactory position in regard to their relations with British buyers, thus spoiling the good reputation already obtained from some of the pioneer shipments. That grading is playing an important part in other countries is instanced by a report on the official records at various stock centres in Canada, which show that over the whole of that Dominion only 11·1 per cent. of select bacon pigs are produced. This is from a table comprising the following classes: Selects, thick, smooth, heavy, shop pigs, lights, and feeders. It is shown that where farmers are endeavouring to produce the select type much larger percentages have been obtained, as instanced in the districts of Toronto and Montreal, which show 20·5 and 19·5 respectively, as against Edmonton with 2·4 per cent. If one compares the 11·1 per cent. of selects marketed with the fact that 85 per cent. of the Danish pigs grade select—that is, suitable for export to Britain—one then begins to realize what our position is and what our problems may be in the future.

CROSS-BREEDING FOR BACON TYPE.

It has been well demonstrated by those countries which are leading in the production of the best-type bacon carcase that no purebred pig of any special breed conforms to the present requirements, which can be met only by a crossbred. The various types of purebred pigs all more or less have points which debar them from being classed as selects for export bacon carcases. There is no one special cross which excels all others in its ability to produce a first-grade carcase; the latter can be obtained in various ways. In Denmark, which produces the highest percentage of selects, a cross with the Large White boar on the native Landrace sow is general. It took a long time finally to decide on this, and the decision was only arrived at after considerable investigation and experiments, but it is now the rule. Ireland is credited with producing the longest carcase, and the Irish breeders, following out the system practised by the Danes, use Large White and Large Black (Devon) boars on their native Large Ulster sows. Canadian breeders, while using Large White and Large Black boars on different type sows, such as Berkshire and Yorkshire (Middle White), also use largely the Tamworth boar on Berkshire and Yorkshire sows.

Each of these crosses is credited with producing a first-class carcase suitable for export to Britain. The last-mentioned cross (Tamworth-Berkshire or Yorkshire) is one which we in New Zealand are largely adopting, and it is proving of great value in supplying the largest number of our select carcases to-day. The Large Black-Berkshire cross has only supplied a very small proportion, owing to the fact that breeders have been relinquishing the Large Blacks on account of

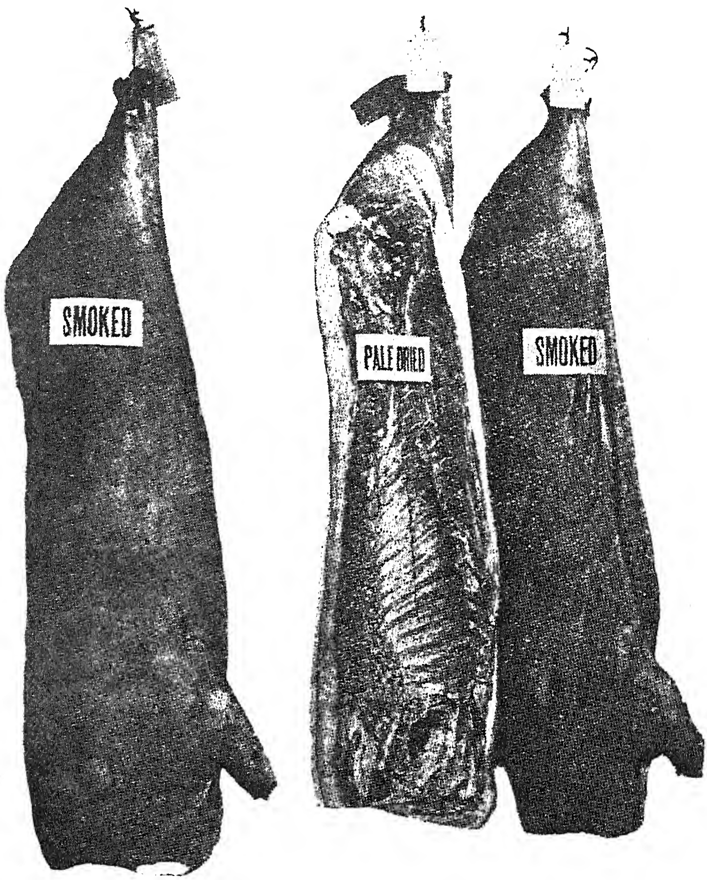


FIG. 4. TYPICAL SIDES OF IRISH BACON AS SOLD IN THE BRITISH MARKET.
[*South Australia Journal of Agriculture.*

weakened constitution brought about by inbreeding through the want of new blood. This state of affairs may be remedied in future, however. Some high-class representatives of the Large Black and Large White breeds have been presented in England to the New Zealand Government, and it is proposed in due course, after arrival, to place these pigs at one or more of the Agriculture Department's farms. The progeny would subsequently be at the service of breeders. This is a step in the right direction, as it will place us in the position of having in the

Dominion the three largest and longest types of pigs to choose from, which will be invaluable for crossing with our other types for bacon purposes. Of the three, the Tamworth is at present doing the pioneer work and is being accepted by breeders all over the Dominion. The other types will take their place in due course, as breeders wish to use them.

It is well to mention that the Large White has one objection—that is, its liability to sun-scald. This might produce a considerable

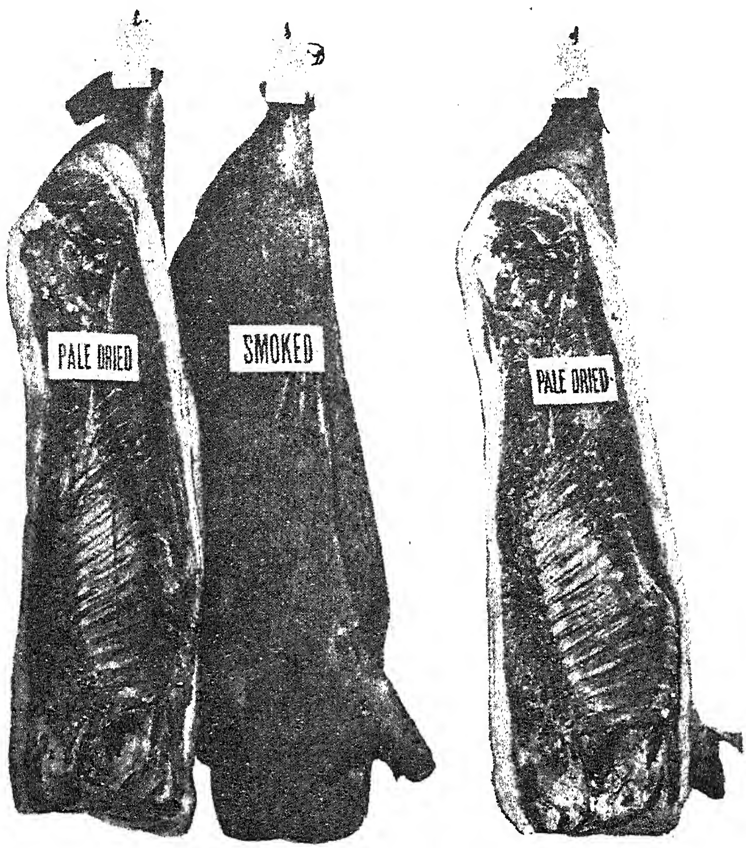


FIG. 5. TYPICAL SIDES OF DANISH BACON AS MARKETED IN BRITAIN.
[*South Australia Journal of Agriculture.*

proportion of unsightly carcases which would be rejected for export, unless special provision is made on the farms for the pigs to be protected by natural shade or artificial shelters. An objection also is raised against all the black breeds by British high-class grocers—that these breeds produce a carcase with the underline discoloured, this being called "seedy cut" or "black belly." This is considered a disadvantage in their business, as the cuts from that part of the carcase—namely, "prime streaky" and "thin streaky"—often fetch

higher prices than prime loin cuts. White pigs do not have this defect, nor do some of the coloured breeds, of which the Tamworth is one. The question of "seedy cut" has not been considered by our breeders to be of any importance so far as local requirements are concerned, but it must be taken seriously when exploiting the British market, and breeders are advised to make it a strong point when selecting their types for future breeding.

CONCLUSION.

In conclusion, farmers are advised not to allow prejudices in regard to a certain type of pig to overrule them in their future operations. Prejudice can be carried too far in relation to live-stock, especially pigs, and may result in retarding the expansion of the bacon industry. They should keep in mind the requirements for overseas trade, and build up to that standard, establishing harmony between producer and exporter, together with the confidence of the British curer. The possibilities are here in New Zealand with its exceptional facilities for the breeding and growing of pigs, and given proper organization there is good reason to anticipate the building-up of a large export trade.

LUCERNE-GROWING IN SOUTH AUCKLAND.

EXPERIENCE OF A CAMBRIDGE STAND.

T. H. PATTERSON, Instructor in Agriculture, Auckland.

LUCERNE is undoubtedly gaining in popularity in the Auckland Provincial District, and the total area devoted to the crop has steadily increased during the last five years. A number of co-operative trials have been carried out between different farmers and the Department of Agriculture, and much useful information gained, of which the following record is a good example.

In 1920 Mr. L. B. Dougherty, of "Green Hill," Cambridge, decided to put an area of 5 acres of his dairy farm into lucerne. He applied to the Department at Auckland for advice. A co-operative trial was set out with the object of demonstrating the value of cropping preliminary to sowing in lucerne, and later to try some control measures for root fungus (*Rhizoctonia medicaginis*). This root parasite has shown up on many areas of lucerne in the Waikato and Bay of Plenty during the last five years.

The area was ploughed out of permanent pasture in August, 1920, and sown in soft turnips in December following. The crop, owing to unfavourable weather, proved a comparative failure. In the following autumn (March, 1921) the ground was prepared for barley and vetches. This crop did well and was grazed off with pigs.

The soil was ploughed in the August following, disked twice in September, and 16 cwt. of ground limestone was applied on 23rd of that month. It received two strokes of the tine harrows on the following

day, and was rolled two days later with the Cambridge roller. On 14th October the paddock was cultivated with the spring-toothed cultivator to kill weeds and loosen the surface. On 14th November, late in the afternoon, 3 cwt. of inoculated soil per acre was applied, and the area was immediately tine-harrowed twice. On 16th November it was rolled, and sown on the following day. Four acres were sown with 10 lb. per acre of Hunter River seed in 7 in. drills. The following manure-mixture was applied with the seed: Superphosphate, 2 cwt.; ground rock phosphate (Nauru-Ocean), 1 cwt.; sulphate of potash, ½ cwt. One acre was sown with 10 lb. per acre of Grimm lucerne.

The season proved very wet, and weeds grew strongly. Before the first cut was made on 1st February, 1922, the lucerne looked hopeless on account of weeds—mainly annuals. After the lucerne was cut and

MR. DOUGHERTY'S STAND OF LUCERNE.

Photo taken 26th January, 1923, just before cutting second crop of season. Lucerne not yet in flower.

stacked the area was tine-harrowed twice and was made much cleaner. On 10th April the second cut was made, and there was still more weed-growth than lucerne. It was again cultivated, using this time the tine cultivator. In May the tine harrows were used again. In early June dry dairy cows were put on, and the lucerne was grazed. This procedure left the area clean for the winter. From 8th to 24th August the tine cultivator was used to clean out weeds, and the area was top-dressed with a mixture of superphosphate and ground rock phosphate (Nauru-Ocean).

The first cut of the 1922–23 season was made on 14th December and stacked later. Though somewhat weedy, it made good hay. The area was again cultivated with the tine cultivator after the hay had been taken off. The second cut, made in the last week of January, was very

satisfactory. The lucerne was practically free of weeds, and the vigour of the stand was apparent on inspection. The accompanying photo was taken just previous to cutting.

As yet no root fungus has appeared in the crop, though it is found in the district. It is hoped that the vigour maintained by good treatment will enable the lucerne to become resistant to invasion.

COMMENT.

A lucerne crop should never be considered hopeless so far as weeds are concerned. This is especially the case in the early stages of its establishment. The wet, cool summers of the last two seasons made the eradication of weeds extremely difficult. Normal summer weather would have made the task easier. Despite the unfavourable weather, however, the weeds were conquered in Mr. Dougherty's case. Liming, of course, is necessary. Top-dressing with phosphates consisting mainly of superphosphate may also be regarded as essential. This, added to the cutting, assists materially in the control of weeds.

After experience with both methods, I am of opinion that lucerne sown after a clean permanent pasture is better in many cases than resorting to preliminary cropping. The grass-sod should be broken in early winter by skim-ploughing, and the area reploughed deeply in the spring following. It should then be worked down, limed, and sown about November. Comparing broadcasting with drilling, I would advise on the lighter soils, such as those of Waikato, Bay of Plenty, and elsewhere in the province, sowing broadcast. Drilling half the seed one way and crossing the area at right angles with the remainder is to be recommended.

The importance of regularly top-dressing and cultivating after cutting, for the maintenance of a vigorous stand free of weeds, cannot be over-emphasized.

In the south Auckland district dairy-farmers particularly can use profitably a small area—up to 10 or 15 acres—of lucerne. It reduces the area that need be devoted to special crops. Cutting permanent pasture regularly for hay is not recommended, because the growth produced when the field is shut up does injury to the better grasses. It must not be forgotten also that lucerne is the highest-grade crop that can be produced from the nutrition point of view; moreover, it leaves the soil in an improved condition after the stand is broken up.

Inspection of Farm Engines.—The Board of Agriculture has in the past endeavoured to obtain exemption from inspection for farm engines and motors of less than 6 horse-power, as it is recognized that practically nothing is achieved by such inspection. An amendment to the Inspection of Machinery Act was introduced into the House last session, and was referred to the Labour Bills Committee for consideration, but went no further. At its last meeting the Board decided to take up the matter again in due course.

Registration of Apiaries.—The total number of registered apiaries at the close of the last official year was 8,007, representing a total of 111,100 hives.

PREVENTION OF THE SPREAD OF STOCK-DISEASES.

FUNCTIONING OF STATE VETERINARY SERVICES.

Presidential Address by Professor H. A. WOODRUFF, of Melbourne, to the Veterinary Section, at the Annual Meeting of the Australasian Association for the Advancement of Science, held at Wellington, N.Z., January, 1923.

IN accepting the invitation to act as President of this Section owing to the very regrettable absence of my friend and colleague Dr. S. S. Cameron I was not unmindful of the duty devolving upon me of preparing an address for your consideration. The choice of a subject was by no means an easy one, but for a number of reasons the one selected was thought to be appropriate: Firstly, because the stock interest, both in New Zealand and in the States of the Commonwealth, is a very important interest, and in relation to world requirements of food and clothing is one of growing importance; secondly, because of the absence of many of the most serious contagious diseases of animals in Australia, and even more in New Zealand (to use the words of an old writer, "Let him that thinketh he standeth take heed lest he fall"); thirdly, because of the necessity for the introduction of purebred stock from abroad for the maintenance and improvement of the excellence of our stock here; and, fourthly, because we as a profession have the responsibility of advising the Governments of our respective States in this matter, and with every increase of our scientific knowledge of the incidence and causation of stock-diseases our advice will require to be modified and adjusted to fit the known facts.

There is little need to spend time in reminding the majority of my audience of the ravages made by some of the more virulent contagious diseases of animals in the older countries of the world, but it may be that some of my hearers are not familiar with the magnitude of the losses which have occurred, and which have compelled Governments in all civilized countries to institute and organize a veterinary sanitary service.

"In Great Britain up to the time of the invasion of the cattle-plague in 1865 it may justly be said that veterinary sanitary science, except in the Army, had no existence so far as the prevention of contagious disease is concerned. In 1865 cattle-plague was introduced into England on 24th June. In October it was calculated that 17,000 cattle had been affected. In November only four counties in England were exempt, and the malady was present in nineteen out of the thirty-three Scotch counties. Further, during 1865 and 1866 some 279,000 cattle were reported sick, and 233,000 died or were killed."* But in addition to cattle-plague other stock-diseases were taking toll of the national wealth. "Up to 1869, for thirty years since the introduction of the two contagious maladies, foot-and-mouth disease and bovine pleuro-pneumonia, it was estimated that the loss from these alone amounted to five and a half million cattle, roughly valued at eighty millions sterling."*

* *Veterinary Sanitary Science and Police*, vol. I. (George Fleming.)

Even in recent days just prior to the war and with an organized veterinary staff the losses due to foot-and-mouth disease alone in European countries were immense. "In August, 1911, 37,000 outbreaks of foot-and-mouth disease were recorded in Germany; in July of the same year 12,000 were recorded in Belgium, and 4,000 in Holland; in France there were 16,000, and there it was estimated that the loss would amount to over fifteen millions sterling." (Sir Stewart Stockman.)

In those earlier days before the advent of a State veterinary sanitary service it is not surprising that contagious diseases of animals should have spread from country to country, and one has only to read the theories of the etiology of what we now know to be specific contagious diseases to understand how entirely uncontrolled and, indeed, uncontrollable they appeared to be. So long as "spontaneous generation" was believed to be possible, and when mysterious miasmatic and telluric influences were thought to be all-sufficient factors in the causation of disease, preventive measures were clearly impossible.

Now, this inability to control the spread of disease coincided in point of time with a very natural desire on the part of colonists in different parts of the Empire to import high-class pedigree stock from Great Britain in order to establish purebred studs and to improve stock generally. Thus the chances of introducing into Australia and New Zealand the prevailing animal-diseases from Europe were considerable, and it is probably owing mainly to the length of the sea voyage that comparatively few of the animal scourges found their way in. On this point it has to be remembered that races of animals which have for many generations been free from any particular contagion are, generally speaking, in a highly susceptible condition should the chances of infection ever occur. This, indeed, makes it the more surprising that in the case of some of the actively contagious diseases which have been introduced into Australasia they have not spread far from the primary infected place.

The wonder is not that bovine pleuro-pneumonia was introduced into Australia in 1858 and spread over the majority of the States (Fleming, vol. 1, p. 407), but that, having been introduced into New Zealand in 1864, it did not become widespread. Equally remarkable is the fact that sheep-scab, having been introduced and spread to several of the Australian States, should have been eradicated. Again, it is surprising to learn that foot-and-mouth disease—that most contagious and most elusive disease of stock—should have been introduced into Victoria in 1872, and yet that the outbreak was confined to the initial herd, and following destruction of the entire herd, on the advice of the late Graham Mitchell, M.R.C.V.S., that it spread no further.

In the case of those diseases with long incubation periods, such as glanders in horses and rabies in dogs, it is extremely difficult to understand the immunity of Australia and New Zealand. Glanders was, indeed, introduced into Sydney in a troupe of circus-horses which had been brought over from America. On inspection at the port the existence of glanders was recognized by the late Edward Stanley, F.R.C.V.S., the affected horses were at once destroyed, and the rest of the animals quarantined on an island. But what a stroke of fortune

that the disease should have been in a clinically recognizable form in these pre-mallein-test days! For the detection of these enemy aliens and their prompt suppression great credit is due to the early veterinarians. Even the first outbreak of contagious bovine pleuro-pneumonia in Australia was diagnosed by the late Henry Wragge, M.R.V.C.S., while still confined to one herd, and slaughter of the entire herd was advised. Action was, however, delayed pending inquiry by a Royal Commission, and the delay proved fatal indeed.

One factor of importance in limiting the spread of contagion in Australia a generation ago was probably the sparseness of the cattle population and the comparatively few sales and transfers of stock as compared with conditions in Europe.

There are, unfortunately, other diseases, insidious, unknown, unsuspected at the time, which have succeeded in getting in, piroplasmosis or tick-fever being a notable example. In this case there is no authentic information as to how and when the cattle-tick [*Margaropus australis* was introduced into Australia, but according to the evidence collected by Gilruth it appears probable that Asiatic Brahma cattle imported from Batavia in 1872 were responsible, although the first serious mortality to be recorded was not till 1880, in a mob of cattle introduced from Queensland into the Northern Territory.

But now consider some more recent outbreaks of contagious disease in countries where the diseases were—although for the time being foreign—quite well known, and therefore more or less thoroughly guarded against. The return of army horses to the United Kingdom after the South African War coincided with an increase in the number of outbreaks and number of animals attacked with glanders, and this marked increase continued from 1901 to 1907. But, besides the dispersal of ex-army horses, another factor operated and was probably of greater importance—namely, the failure of the authorities to deal with "in-contacts" after discovering a clinical case, and the private use by the owner of the mallein test, followed by the sale and dispersal of apparently healthy reactors. Therein is a lesson which is capable of application in connection with other diseases.

A further disease of horses, epizootic lymphangitis, was introduced at the same time from South Africa, and it is highly creditable to the veterinary profession that within a year or two it had been completely eradicated and is now unknown in Great Britain. Still another example of unconscious introduction of disease into a country is furnished by New Zealand, in the case of anthrax conveyed in bone manure from India and elsewhere. The success of the practice of bone-sterilization and the freedom of the Dominion from anthrax in recent years are greatly to the credit of the veterinary staff of the Department of Agriculture and to our old friend Dr. J. A. Gilruth.

Foot-and-mouth disease has furnished many examples of unconscious introduction despite all kinds of precautions, among them an outbreak in Edinburgh some years ago, which was eventually put down to infection by means of hay or straw either intended for fodder or used for packing eggs from Holland. This latter possibility is one which is not easy to guard against, but must remain under suspicion, to be investigated whenever unexplained outbreaks occur.

Even more insidious was the introduction of foot-and-mouth disease virus in vaccine ("Vaccinia") lymph imported commercially into the United States from Japan in 1902 and 1903. The long period during which the vaccine remained infective, and the very mild type of foot-and-mouth disease set up, increased the difficulty of proof, and remain serious factors to be reckoned with in the importation of biological sera and vaccines from abroad. Many more recent outbreaks of this disease in Great Britain are of unexplained origin, but with the great prevalence of the disease in neighbouring countries this is not so difficult of understanding, and we in Australasia can reckon on a much greater immunity because of our much greater distance from infected places.

Another disease of some concern to us must be mentioned—namely, dourine of horses. With its pristine home in Asia, this disease has also been prevalent for a long time in North Africa, and was apparently introduced into Europe by means of Arab stallions in the early years of the nineteenth century. The disease was first suspected in the United States in 1885, and recognized by W. L. Williams in 1886. The introduction was traced to a Percheron stallion imported from France in 1882. From Illinois State the disease spread to Nebraska, and for over twenty years various outbreaks—more or less serious—were traceable to this primary importation. Canada became affected in 1904, but by strenuous measures had the disease well under control by 1909, and eventually successfully stamped it out. A fresh outbreak was discovered in the United States in 1911, in Iowa, and this in turn was traced to the importation of a Percheron stallion from France in 1909. France is being continually reinfected by the movement of stallion asses to and from Spain, where the disease is commonly prevalent.

The recent introduction of rabies into Great Britain after a period of freedom lasting many years is not difficult of explanation. The extraordinary traffic to and from the Continent during the war, and especially the home-coming of many thousands of soldiers anxious in many cases to retain canine pets and mascots, readily account for the introduction of so wily an invader as rabies. Australia and New Zealand ran considerable risk of suffering the same invasion, but the strictness of the authorities and the general good sense of officers and men returning home were successful in preventing what would have been a very serious occurrence. The veterinary authorities in Great Britain are to be congratulated on the success of the energetic policy of control and eradication, and once again Great Britain can be declared free from this disease.

The last outbreak of contagious disease to be mentioned in this group of surprise importations, and in many ways the most dramatic, is that of cattle-plague in Belgium, in August, 1920. This disease had been unknown in Western Europe since 1870. It had been the cause of the initiation of veterinary sanitary services in most European countries, and all chances of its reintroduction were thought to be well guarded against. The facts are that a cargo of zebras from British India and consigned to Rio de Janeiro touched at Antwerp, where the animals were disembarked at the quarantine station pending reshipment on another boat. Some of these animals died in the quarantine station, but no *post-mortem* examinations were made, and

cattle-plague was not suspected. The survivors were transhipped and proceeded on their voyage. Then other shiploads of cattle imported for food purposes came into Antwerp, passed through the quarantine station, and were distributed to various abattoirs. In the Ghent abattoir the disease broke out—but its real nature was still unsuspected—and then by one unfortunate happening the general spread of infection began. A consignment of German cattle sent over for reparation purposes came into the Ghent abattoir, and were then dispersed to various country districts. So the disease spread, and its real nature was discovered. The lessons to be learned are sufficiently obvious.

In addition to these more serious contagious diseases there are a number of parasitic diseases which require consideration at the hands of the State veterinary authorities. Notable examples are the conditions due to the ox-warble (*Oestrus bovis*), the sheep nasal bot (*Oestrus ovis*), and the worm nodule of cattle (*Onchocerca*). The failure of the ox-warble to become acclimatized in Australia, despite its inevitable importation in the early days and its escape from quarantine on several occasions during recent years, is not readily explained. Symons, in a paper read before the Australian Veterinary Association in Sydney last year, brings forward evidence to show that in no country in the Southern Hemisphere is the ox-warble established. On the other hand, the nearly related nasal bot-fly of sheep has got a firm hold in Australia, and is proving a source of considerable loss in lowering the condition of sheep, although it rarely causes any mortality. What are the factors which account for the different behaviour of these two parasites in a new country I am quite unable to say. In the case of *Onchocerca* it may be said that the species common in northern Australia, or nearly related species, are found in many other parts of the world. There is, however, no evidence to show that the infection is spreading southward in Australia, and in Victorian cattle, at any rate, cases are practically unknown. There, again, the life-history and the vital factors are as yet unknown.

But now the question arises, Are we, through ignorance or inertia, or both, allowing the introduction of various fresh contagious diseases of animals into our erstwhile clean country? Are we perpetrating similar disastrous errors to those committed by our forefathers? I think that with regard to at least two diseases of cattle we shall have to plead guilty—namely, contagious abortion of cattle and Johne's disease or pseudo-tubercular enteritis. With respect to the former, the mischief has already been done. We erred through ignorance in the days before definite diagnosis was readily possible. With regard to the latter, we are probably now sowing the seed—largely for want of serious concern—of a harvest whose magnitude it is impossible to assess.

About bovine tuberculosis I have said nothing, since the distribution is already practically world-wide, and also because tuberculin testing of imported cattle is practically universal. Some regulation of inter-State traffic will be called for in Australia if and when a forward movement commences in any State for the eradication of the disease. In this connection the procedure under the accredited herd system and the standardization of the tuberculin test in the United States deserve careful study.

A POSITIVE POLICY.

And now, having surveyed very cursorily the field of possible importations, may I be allowed to put forward the positive policy which it is the main object of this address to commend to you. It may be stated in a number of propositions as follows: (1) The chances of the importation of infection are numerous, and every known chance has to be guarded against; (2) the interests involved are economically very important; but (3) the necessity for pedigree-stock exchange between the various States and countries is also extremely important; and (4) the modern scientific methods for the detection of disease-infection are incomparably greater than those of a generation ago, and they are being improved and added to daily; (5) thus it behoves the veterinary profession in general, and Government veterinary advisers in particular, to revise continually their methods and regulations, their prohibitions and exemptions, so as to allow the maximum facilities for trade and for importation and exportation of stock, while at the same time affording all the protection which science can devise. This protection will not only apply to well-known recognized dangers, but will look forward to possibilities of danger from sources hitherto unsuspected.

Veterinarians in Great Britain have often been taunted that their most important instrument for the control of contagious disease was the pole-axe. The further taunt has been applied to Government veterinary officers that their only policy to exclude contagious disease was rigid exclusion of all animals from abroad. I venture to put forward the view that our increased scientific knowledge should be used wherever scientifically possible in relieving this drastic and rigid policy. In order to be in a position to approve this view, let us briefly survey the various methods available for the exclusion of infection from a foreign source.

(1.) The first method is the most obvious and direct—namely, the prohibition of importation of live animals from any country where contagious disease of animals exists. Rigidly interpreted and administered, this method provides a very real protection against the introduction of infection, but it is a serious restrainst upon trade in general and upon the introduction of pedigree stock in particular. It relieves the Government veterinary advisers of a great deal of responsibility, and it affords absolute protection in the fiscal sense for certain vested interests within the country.

An excellent example is afforded by the embargo on the importation of Canadian store cattle into the United Kingdom, an embargo which has just been removed. The avowed reason for the embargo was the fear of the introduction of contagious disease into Great Britain, and the particular disease which was used as a stalking-horse was contagious bovine pleuro-pneumonia. As a matter of fact, all the evidence available pointed to the entire freedom of Canada and the United States from this disease for many years, but two factors prevailed until a few months ago to keep the embargo in being. The one was the political influence of the vested interests, particularly in Ireland, which did not desire an invasion of Canadian store cattle, and the other was the departmental shirking of responsibility on the part of the Ministry of Agriculture with or without the advice of their veterinary staff.

Prohibit and keep out of trouble and responsibility seems to have been the departmental slogan. I suggest that "Importation whenever possible without danger" should be the watchword of an efficient veterinary staff, for, as has been pointed out elsewhere, while any fool can prohibit and avoid responsibility, it needs a trained man to allow importation under regulations.

(2.) Combined with prohibition of live-stock there must be prohibition of entry of animal products such as hides, hoofs, horns, bones, wool, &c., either absolute or except after efficient sterilization of such materials. Such other materials as hay, straw, and manufactured foods such as oil-cakes may also have to be provided against, and, as we have seen in the case of foot-and-mouth disease, vaccines and sera of animal origin are potential dangers. Suitable regulations and certificates, continual vigilance with regard to the prevalence of animal-disease in foreign countries, and power to promptly exclude such products as and when their importation appears to be dangerous, afford the necessary precautions in relation to these matters. Assuming now, however, that total exclusion of live animals of different species is not in operation, but that importation with safeguards is allowed, what are these further safeguards ?

(3.) In the case of many diseases infection or non-infection can be determined by means of certain biological tests. The most commonly applied is, of course, the tuberculin test, and in this connection a degree of reliability can now be attained which leaves little to be desired. A standardized method of testing, using the best combined test (a matter well worthy of discussion in light of world experience), and using efficient tuberculin, applied either by the official veterinary representative of the importing country or by a Government official of the exporting country, should be required from the country of origin of the stock. In order to be able to give the necessary guarantee, both in the interests of the exporter and the importer, the British Ministry of Agriculture has established a testing-station where animals for export may be tested prior to shipment. Mallein testing of horses, asses, and mules can be applied in a similarly reliable manner, and in both cases the tests can be applied at the port of entry. Other tests which might well be applied to the animals concerned are the avian tuberculin tests for Johne's disease, the agglutination test for contagious abortion of cattle, a similar test recently worked out by Heslop for pleuro-pneumonia of cattle, and the complement fixation test for dourine in horses.

These immunological tests will surely be used increasingly, and the list of diseases allowing of their application is also increasing yearly, so that the certification by trustworthy persons in the country of origin of an animal for export will become of more and more importance. As has been pointed out, these same tests can, if desirable, be repeated at the port of entry.

(4.) Another time-honoured measure of protection is that of quarantine at the port of entry. This is a very valuable measure in the case of animals which have been only a short time in transit, and in connection with diseases with a short incubation period. It is, however, by itself an inadequate safeguard against such diseases as tuberculosis, glanders, Johne's disease, bovine pleuro-pneumonia, and rabies, while

such parasitic conditions as warbles have often outlived the regulation period. Quarantine, then, while useful, cannot be relied upon alone.

(5.) Veterinary inspection at the port of entry is, of course, an essential precaution, and if this is made to include a reference to the ship's log for any history of disease or mortality during the voyage, and repeated inspections during the quarantine period, together with application of the laboratory and biological tests previously mentioned, it affords the most solid measure of protection possible.

(6.) There are still one or two further methods by means of which a State desirous of importing pedigree stock can secure protection against infection. One of these is to require what may be called a certified history of the particular animals from the date of birth. Such a history is furnished by the breeder and owner, and is to be endorsed by the veterinary officials of the exporting State. The method rests upon the mutual honesty and integrity of stockowners and departmental officers, and, while it is necessarily limited, it does provide a means for the inter-State exchange of pedigree stock.

Another method, that of the buffer State, can sometimes be applied. If, for example, it is desired to import Queensland cattle into Victoria the latter State is safeguarded by the dipping regulations of the State of New South Wales, and by requiring a period of three-months stay of the cattle in New South Wales. This three months in the buffer State serves the purpose of quarantine.

The last method of protection to be mentioned is just that of common honesty, both in the inter-State and international relations. Honest international notification of the existence of contagious disease among animals at the earliest possible moment is still the best policy, for it becomes reciprocal, and, to apply another proverb, "Forewarned is forearmed."

VETERINARY TRAINING.

And now I desire, in conclusion, to suggest two directions in which this professional duty of allowing the fullest facilities for international trade in live-stock compatible with the safety of our own flocks and herds affects the problem of veterinary education.

Firstly, it must be clear that for the efficient performance of the duties of a State veterinary officer special qualifications are necessary. The training required for a general practitioner is not enough. The special qualifications required may no doubt be attained to a considerable extent after appointment to a junior post by the man who will read and who takes study leave for practical work in a laboratory. But I venture to suggest that a special course of training not very long after graduating is the best equipment. It is just a matter of choice between practical experience first, followed by hardly acquired scientific and technical training in a post-graduate course on the one hand, and a four-years graduation course followed by a specialized fifth year adapted solely to the scientific technical work of the State sanitary veterinarian. The one method is exemplified in the regulations for the fellowship (in this branch of work) of the Royal College of Veterinary Surgeons. The other is the method set out in the post-graduate diploma courses of some of the English universities, such as the D.V.H. of Liverpool, or the course for the degree of M.V.Sc. of Melbourne.

Just prior to the war a departmental committee was appointed by the President of the Board of Agriculture in England "to inquire into the requirements of the Public Services with regard to officers possessing veterinary qualification, and to consider whether any further measures can with advantage be adopted for the selection and training of students with a view to such employment." The committee reported that, with regard to the Indian civil veterinary department and the colonial veterinary services, in both cases there was a deficiency of suitable candidates. Further, "it was generally agreed among the professional witnesses that the course for the qualifying diploma was not of itself sufficient training for future officers in the Government service. At least a year in post-graduate work and study would be a great advantage."

This criticism of the ordinary course applies specifically to the four-years course leading to the diploma of M.R.C.V.S. in any of the affiliated British veterinary schools, but it must be equally true in principle of any graduation course which is on general lines; and a year of specialization in the laboratory, with as much field-work in the abattoir and on the dairy farm and in the quarantine station as may be, is, in my judgment, the minimum requirement for an appointment as a Government veterinary officer.

The second effect this broader view of the State veterinary officer's duties must have upon his education is that he will have a desire to continue and extend it. The British departmental committee referred to above suggest several inducements to university students possessing a thorough grounding in general science to enter the veterinary profession and the State service. Among these they rightly include special facilities for research work. I have suggested elsewhere in this address that increasing knowledge makes for increasing security and diminishes the risks of importing infection. But there are many hiatuses in our knowledge of the causation and prevention of contagious diseases of animals. Who are to fill the gaps? To the scientifically trained veterinary officer there must come practical problems demanding scientific investigation and research. If he is of the right type such problems come as a challenge. He may be qualified to carry out the research more or less alone; or he may find it necessary to seek the collaboration of the bacteriologist, or pathologist, or parasitologist, in the laboratory. What is certain is that the practical knowledge of the field officer must be combined with the scientific and technical knowledge of the laboratory worker before many of the problems of contagious disease can be solved. Further, it requires the scientifically trained officer in many cases to see the problem in its proper proportions, and in order that he may go on seeing difficulties and appreciating risks some facilities for special investigation and research must be given him from time to time.

I close, then, with a plea for an opening door to inter-State and international stock traffic, because with increase of knowledge there is increased security, and with the further plea for the employment of men of the highest standard obtainable, who with reasonable facilities and encouragement for research will continually add both to our knowledge and our security.

WATER CONTENT IN EXPORT BUTTER.

AN EXTENDED TESTING-SYSTEM FOR NEW ZEALAND.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

IN the earlier days of the dairy industry the manufacture of a butter of a satisfactory body and texture virtually precluded the incorporation of any unreasonably large percentages of water, inasmuch as the water could not be so incorporated as to cause the mass to be homogeneous. Water pockets resulted, and this free water at times leaked through the boxes, and thus the general appearance of the packages as well as the quality of the butter were more or less unsatisfactory. The advent of the combined churn and butter-worker has, however, made possible the manufacture of a butter which will retain a larger proportion of water that the cow has incorporated into the milk and the separator has retained in the cream. With this method of manufacture comparatively high percentages of water may be retained in a butter without spoiling the body and texture.

Britain, the greatest butter-importing country in the world, years ago fixed its maximum legal limit of water in creamery butter at 16 per cent. Practically all countries producing butter in considerable quantities have found it expedient to adopt the same legal maximum. In some of these countries a legal minimum for butterfat content has been arranged. Usually this is indicated at 80 per cent., as in Canada, the United States, and New Zealand. The Australian Commonwealth, however, has adopted an 82-per-cent. minimum for fat content, and this variation from the more generally recognized standard has caused some trouble to New Zealand dairy companies and exporting firms doing business with Australia during recent months.

The combined churn and butter-worker has to be handled with care and judgment if the operator is to succeed in turning out a butter which will not be too low in water content nor yet above the legal limit. It may be accepted that no dairy-company directorate desires to manufacture a butter which comes within either of these classes, and certainly not the latter. To safeguard the suppliers of the company against unnecessary loss in overrun, and the company against the possibility of being mulcted in fines or loss in the overseas market, it is necessary that the buttermaker should do a considerable amount of testing of the butter for water during and subsequent to the process of working.

The importer of butter into Great Britain, if found with such butter containing an excess of water, is liable to a maximum fine of (*a*) £20 for the first offence, £50 for a second, and £100 for a third offence, and (*b*) a sum equal to the value of the goods. In addition, some dairy companies have learned to their sorrow that the loss entailed in handling excess-water butter in Britain is very heavy. The business of the importer may be very much prejudiced if some of his clients who are retailers are found with butter of this nature, and the retailer's business, if he be prosecuted, may be very seriously damaged.

Continental countries exporting butter to the British market have endeavoured to protect their trade. Butter leaving Denmark for Britain, if found to contain a water content above the legal maximum, may be confiscated. Should a butter being sent from Holland be found to contain between 15½ and 16 per cent. the factory or owner, if a member of the Butter Control Institute, is penalized by a nominal fine. If the butter contains more than 16 per cent. of water the position may be met by a fine and the reworking of the butter. If this does not cause the factory to do consistently good work the registered mark or brand is withdrawn, and the factory or owner is suspended from membership, and may not use the recognized brands.

INAUGURATION OF THE NEW SYSTEM.

New Zealand adopted the usual standards of 16 per cent. as the legal maximum for water, and 80 per cent. as the legal minimum for butterfat, for butter for export as well as for local consumption. Until the 1922–23 season there was little if any complaint from Britain respecting an excess of water in New Zealand butter. During that season, however, a number of complaints were received. The Government recognizes the necessity of protecting the dairy industry—which is now of prime importance to the Dominion—and to this end approval has been given to a recommendation of the Dairy Division, which was endorsed by the various dairy conferences last winter, to the effect that the butter of one box of each churning of each lot of butter received for grading for export should be tested for water content.

Arrangements are now being made to get this service completely organized forthwith, and dairy companies may expect to receive an indication of the water content of the box examined from each churning of butter. This will inform company directorates as to the position regarding their butter, and managers will have an additional check on their working. It is not to be expected that the factory tests and the graders' tests will harmonize exactly, inasmuch as it is known that the water content of butter will vary to some extent from box to box of the same churning, and, indeed, at times, in different parts of one box. It is known that some factory-managers make a butter from which too much water has been taken. The service which will be rendered this season should tend to correct these defects, and the advantage which may be thus gained will undoubtedly more than recoup the cost of the extra assistance required at the grading-stations. The procedure is merely an extension of the existing system of testing occasional churnings, and, as in the past, no butter found to contain water over the legal limit will be permitted to be exported, and will be dealt with under the powers conferred by legal enactment.

It is hoped that under the new system the export of butter containing an excess of water will be reduced to a negligible quantity if not altogether stopped. The seriousness of the position is now recognized in the industry, and the majority of factory-managers are endeavouring to protect themselves and their companies. A smaller proportion are not so particular, and have omitted to do the necessary amount of testing of butter for water during its manufacture. In some instances insufficient care has been taken to keep the balances

and testing appliances in good order. It must not be assumed that more latitude is to be given companies which persist in forwarding for grading butter which contains an excess of water.

Although considerable testing of butter for water was done during the past two seasons, it is believed that the inauguration of this extended system will give greater assurance to those handling our butter in Britain. The Dairy Division invites the hearty co-operation of all company directorates, proprietaries, and dairy-factory managers in establishing confidence in the water content of New Zealand butter shipped overseas.

MAIZE AND MILLET FOR LAMB-FATTENING.

J. W. DEEM, Fields Instructor.

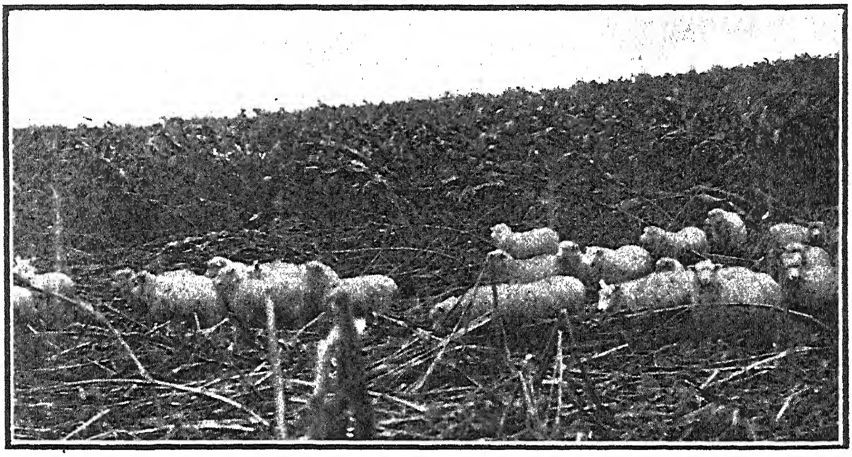
IN many districts of recent years the growing of rape for lamb-fattening has become a very uncertain proposition; in some parts, indeed, there is nearly 100 per cent. of failures. For this reason many fodder crops have been tested to ascertain if a substitute could be found.

Peas have proved themselves useful, but are rather expensive to sow, and late in coming into a proper condition for feeding. Tares and clovers are also useful. From the experience at the Moumahaki and Marton Experimental Farms during the last two seasons, however, it would appear that Japanese millet and maize are going to rank among the best crops as substitutes for rape in districts where the latter cannot be satisfactorily grown. While it must be recognized that neither of these crops will fatten as many lambs per acre as a good crop of rape, quite good results may be looked for.

In a feeding-test conducted at Marton in 1922 lambs gained 7·41 lb. per head in fourteen days on millet, and 16·5 lb. in thirty-seven days. At Moumahaki this year they gained 6·88 lb. in fourteen days on a mixture of rape and millet, and 7·04 lb. on millet alone in the same number of days. Maize for the same period gave a gain of 5 lb. per lamb.

Sowing.—Both maize and millet require sheltered warm positions to do their best, and should not be sown until warm weather sets in. In the Wellington west-coast district from 20th November to the middle of December is early enough, the first week in the latter month being very suitable. The millet sown at Moumahaki on 7th December last season was ready to feed early in January, and when stocked on 3rd February it was nearly 3 ft. high. Millet should be sown at from 16 lb. to 18 lb. of seed per acre, through every coulter of the drill. Where millet and rape are being used 1½ lb. rape and 12 lb. millet is a suitable mixture. Maize should be sown at the rate of 2 bushels per acre. Superphosphate, or two parts superphosphate with one part Ephos phosphate or basic slag, at from 3 cwt. to 4 cwt. per acre, according to the condition of the land, will be found suitable manures.

Feeding.—In order to get the best out of millet it should be divided into several breaks, and feeding started when it is from 6 in. to 9 in.



LAMBS ON MAIZE AT MOUMAHAKI EXPERIMENTAL FARM.

LAMBS ON MILLET AT MOUMAHAKI.

high. It may be left until much older, however—say, 2 ft.—but the subsequent growth is not so good. If allowed to flower there will be very little second growth. Maize is best fed in the flowering stage. If allowed to get much older the stems become rather tough for lambs, and they have difficulty in cutting them down.

Casein.—The manufacture of casein in the Dominion was extended during the season of 1922–23. Some 2,100 tons, most of which was lactic casein, was graded for export. The quality of lactic casein showed improvement, and the quality of some 100 tons of rennet casein which was manufactured was of a very high standard.

TESTING OF PUREBRED DAIRY COWS.

SEPTEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

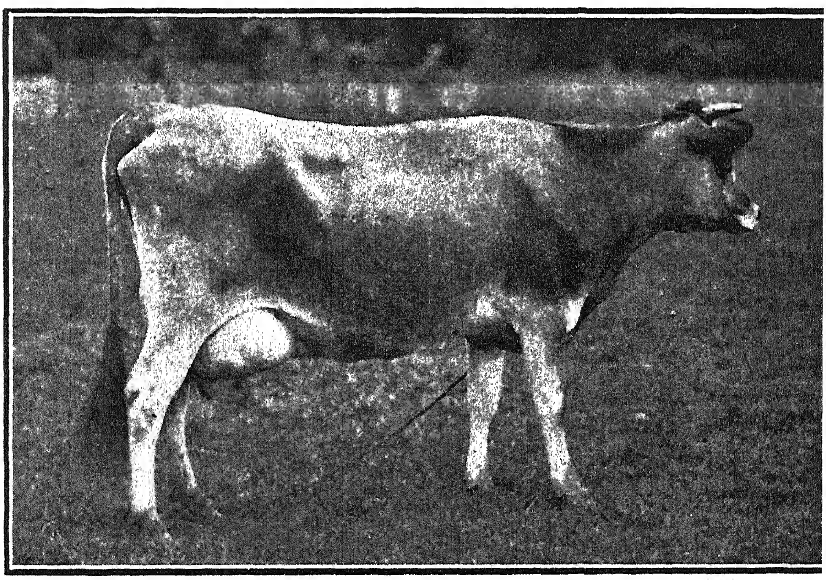
THE following list comprises the record of cows which received certificates during September, 1923. It will be noticed that there are several 700 lb. and 800 lb. records, and other very creditable performances.

Name of Cow and Class.	Tested by	Age at starting Test.		Fat req'd. for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	FRIESIANS.						
Junior Two-year-old.		Yrs.	dys.	lb.		lb.	lb.
Domino Show Belle*	W. I. Lovelock, Palmerston North	2	87	249·2	365	16,477·9	570·44
Brookside Colantha Princess	Cameron Bros., Stratford	2	81	248·6	271	11,479·8	331·37
Ashlynn 95th ..	Piri Land Company, Auckland	1	293	240·5	365	9,205·8	325·08
Dux Darling de Kol..	Frank Ducker, Opotiki	1	330	240·5	293	10,048·7	276·13
Senior Two-year-old.							
Fairmont Pietertje Lady	J. Hart, Tatuanui ..	2	356	276·1	365	19,899·0	720·31
Bainfield Beauty Sylvia	W. D. Hunt, Waikiwi	2	203	260·8	273	13,523·2	526·87
Junior Three-year-old.							
Peria Claudia 1st ..	J. H. Wilson, Matamata	3	19	278·9	266	9,066·7	353·04
Mature.							
Queen of Canada ..	H. R. Green, Kairanga	10	176	350·0	365	22,479·7	849·58
Clover Pledge 2nd ..	T. Henderson, Okaiawa	6	283	350·0	365	23,852·7	806·41
Ashlynn Beatus ..	Piri Land Company, Auckland	7	176	350·0	348	15,535·9	751·79
Friesland Tirania ..	R. K. Macdonald, Edendale	10	0	350·0	301	18,624·5	575·10
Hukituai Lass ..	Frank Ducker, Opotiki	6	321	350·0	356	15,685·7	468·87
	JERSEYS.						
Junior Two-year-old.							
Gowanbrae K.C. Bluebell	A. G. Griffin, Richmond	1	289	240·5	358	10,296·1	577·04
Frenaig Frisk ..	W. Holmes, Ramarama	2	23	242·8	365	10,232·0	566·43
Response	J. Magill, Normanby	1	348	240·5	365	11,104·0	563·33
Round Bush Mymy..	H. T. Mellow, Stratford	1	329	240·5	365	8,385·3	541·65
Shamrock's Jewel ..	C. Jones, Manaia ..	1	347	240·5	365	8,945·0	534·17
Ayesha's Beauty ..	C. Jones, Manaia ..	2	20	242·5	356	8,177·1	476·47
Goldie's Girl's Gift ..	G. A. Berry, Manaia ..	2	10	241·5	365	9,141·8	473·39
Bridge View Lady Hope	L. Wickham, New Plymouth	1	343	240·5	365	8,560·0	472·90
Floral Fox ..	C. B. Herrold, Waiuku	1	342	240·5	363	8,721·1	469·58
Tower View Countess	J. Nicolson, Hawera	1	312	240·5	364	7,986·4	463·65
Lady Love's Farewell	L. W. and J. T. Prosser, Leeston	2	22	242·7	365	7,905·5	451·16

* Owned by Robert Shelton, Ngongotaha.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season. Days.	Milk.	Fat
JERSEYS—*continued.*						
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Neat Pride's Orphan	D. L. A. Astbury, Mangatoki	1 331	240·5	365	7,925·6	439·
Whenuku Lady Bird	T. M. Remington, Westmere	1 340	240·5	365	8,047·7	421·
Eaton Lady Love ..	D. Watkin, Takanini	1 308	240·5	355	5,847·1	409·
Vanetta	J. Nicholson, Manakau	1 364	240·5	349	7,517·7	407·
Avoca Jewel ..	V. W. Nowell, Hawera	2 29	243·4	291	7,272·2	399·
Silverdale Charm ..	H. Doel, Taumarere ..	1 229	240·5	365	7,267·1	394·
Brookley's Baby ..	W. Johnson, Ngaere ..	1 356	240·5	351	6,545·5	393·
Holly Oak Silvery ..	G. R. and H. Hutchinson, Auckland	2 33	243·8	365	6,890·6	392·
Ensley Rose ..	R. F. Wilkinson, Pukekohe	1 308	240·5	365	6,389·1	385·
Silverdale Benora ..	J. Doel, Taumarere ..	1 283	240·5	337	7,316·7	363·
Kaucket's Oriveto ..	G. T. Gibbons, Ngaere	1 344	240·5	299	6,381·5	352·
Rockview Crown Pearl	W. H. Fitness, Rehia	1 263	240·5	339	6,165·8	342·
Primrose Jolie ..	A. Buchanan, Palmerston North	1 332	240·5	365	6,550·8	333·
Brentwood Mignonette	C. A. Willis, Pukekohe	2 58	246·3	310	6,577·1	318·
Binnia Queen ..	H. George, Kaupokonui	1 343	240·5	320	5,067·2	310·
Remuera Belle ..	E. H. Linnell, Midhirst	1 351	240·5	345	5,907·2	302·
Viola's Bright Lady..	A. E. Linn, Normanby	1 332	240·5	296	5,544·4	284·
Westwood Ideal ..	E. A. Harrington, Hukanui	1 326	240·5	328	6,758·8	282·



GOWANBRAE OF K.C. BLUEBELL (A. G. GRIFFIN, RICHMOND).

C.O.R., 1923, Jersey Junior Two-year-old Class: 10,296·1 lb. milk, 577·04 butterfat, in 358 days.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
JERSEYS—*continued.*						
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Kaucket's Rexona ..	G. T. Gibbons, Ngaere	2 9	241·4	276	5,675·4	280·35
Waitekauri ..	T. Foreman, Alton ..	2 5	241·0	322	5,222·1	270·21
Bonny Lass o' Bon Accord	E. K. Clague, Manaia	1 270	240·5	297	3,963·0	255·80
Woodstock Claudia	E. Hofmann, Katikati	2 17	242·2	313	5,500·6	254·74
Waipiko Monica ..	Mrs. C. O'Callaghan, Tikinui	1 331	240·5	311	4,728·4	254·40
Surprise's Superior ..	T. Foreman, Alton ..	1 355	240·5	365	5,350·3	250·29
Richwood Emblem ..	W. P. Begg, Arapohue	1 288	240·5	303	4,447·3	243·31
Senior Two-year-old.						
Oakden Heather Bell	A. L. Hooper, Mahoe	2 340	274·5	365	7,394·2	508·88
Holly Oak's Primrose	G. R. and H. Hutchinson, Auckland	2 102	250·7	365	8,949·9	488·72
Lyra's Majesty ..	A. E. Phillips, Maunu	2 247	265·2	365	7,790·8	462·06
Oak Farm's Fairy Wonder	C. Meuli, Tariki ..	2 360	276·5	355	8,018·1	443·32
Wairere's Buttercup	A. Faull, Stratford ..	2 329	273·4	276	6,289·5	325·78
Three-year-old.						
Sweet Hope ..	H. T. Mellow, Stratford	3 244	301·4	346	9,710·8	601·93
Oakden Gertie ..	S. J. Hollard, Rowan..	3 347	311·7	365	9,380·0	581·10
Society Belle ..	H. Salway, Bell Block	3 312	308·2	365	10,488·7	578·32
Riverlea Pansy ..	L. Wickham, New Plymouth	3 357	312·7	364	10,286·5	575·66
Woodside Pansy ..	G. H. Pearson, Taupaki	3 111	288·1	364	8,826·2	547·54
Ensley Jem ..	R. F. Wilkinson, Pukekohe	3 316	308·6	345	8,458·0	513·65
Volee's Hope ..	J. Nicholson, Manakau	3 334	310·4	365	9,401·3	475·93
Ginger	G. R. and H. Hutchinson, Auckland	3 281	305·1	365	7,649·2	473·67
Faithless	R. R. Dean, Te Kumi	3 172	294·2	300	8,360·7	456·41
Odette	A. L. Hooper, Mahoe..	3 259	302·9	365	6,996·8	440·08
Orange Dale's Diamond	R. J. Wilson, Putaruru	3 286	305·6	341	8,128·0	434·89
Miss Whitefoot ..	G. Buchanan, Paeroa	3 300	307·0	365	8,046·5	431·79
Jersey Park's Myrtle	A. E. Death, Hawera	3 281	305·1	307	6,935·3	424·43
Veronique ..	R. J. Wilson, Putaruru	3 5	277·5	347	6,554·0	352·84
Victoria's Charm ..	E. A. Harrington, Hukanui	3 142	291·2	301	6,327·4	328·66
Trethella's Silvo ..	A. Buchanan, Palmerston North	3 16	278·6	360	4,503·1	283·30
Four-year-old.						
Primrose Maiden ..	H. T. Mellow, Stratford	4 333	346·8	365	9,166·4	650·99
Shamrock's Sweet Sultan	H. T. Mellow, Stratford	4 214	334·8	347	12,128·3	616·32
Serina	A. J. Hale, Hillsborough	4 259	339·4	365	9,055·6	567·71
Fairy Sweet Shamrock	H. T. Mellow, Stratford	4 255	338·9	336	9,944·6	558·68
Fancy's Pride ..	G. H. Pearson, Taupaki	4 277	341·2	365	9,335·7	535·81
Riverina Maria ..	J. Hunt, Nelson ..	4 31	316·6	295	8,904·9	482·26
Silverstream Heather	G. B. Hull, Wellington	4 31	316·6	365	9,628·7	476·83
Halcyon Era.. ..	H. Doel, Taumarere ..	4 25	316·0	349	6,618·7	420·80
Dorothy's Girl ..	E. K. Clague, Manaia	4 358	349·3	306	7,920·0	418·43
Grafton Peppermint	R. J. Wilson, Putaruru	4 291	342·6	348	7,217·2	393·05

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at starting Test.		Fat req'd. for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
		JERSEYS—*continued*.					
Mature.		Yrs.	dys.	lb.		lb.	lb.
Eaton Lady Reynecourt	D. Watkin, Takanini ..	6	23	350·0	365	12,777·3	871·39
Dewberry's Maid ..	H. Salway, Bell Block	5	11	350·0	365	13,216·9	731·26
Duchess of O.K. ..	A. Faull, Stratford ..	7	11	350·0	365	11,697·2	681·67
Holly Bank Buttercup	Farrow Bros., Waitoa	5	273	350·0	360	13,010·4	673·70
Karanga Lady ..	A. Lancaster, Palmerston North	5	7	350·0	365	9,821·5	664·99
Molina Shamrock ..	H. T. Mellow, Stratford	6	307	350·0	365	12,706·1	635·32
Shamrock Sweet Cherry	H. T. Mellow, Stratford	5	35	350·0	303	11,136·6	551·31
Ping Pong ..	J. A. Kurth and Son, New Plymouth	5	44	350·0	365	9,505·7	541·24
Little Jewel ..	R. R. Dean, Te Kumi	7	89	350·0	365	9,874·9	519·82
Oanga 2nd ..	W. H. Jakins, Christchurch	9	277	350·0	365	8,208·8	503·65
Della	J. Nicholson, Manakau	6	256	350·0	334	8,462·8	503·33
Willow Bank Ability	W. Johnson, Ngaere ..	5	18	350·0	316	9,220·2	467·98
Konini's Pet ..	R. S. Coplestone, Eltham	5	358	350·0	347	8,110·9	456·16
Benopi	A. Buchanan, Palmerston North	5	242	350·0	365	6,797·4	443·80
Fernaig Madge ..	G. H. Pearson, Taupaki	5	269	350·0	364	7,307·5	438·88
Golden Locks ..	J. Nicholson, Manakau	7	276	350·0	365	7,231·1	408·39
Dainty's Joan ..	E. K. Clague, Manaia	5	23	350·0	309	7,344·9	394·25
		MILKING SHORTHORNS.					
Junior Four-year-old.							
Sweet Garnett 2nd of Cornwall Park	R. S. Allan, Hatuma	4	359	349·4	365	16,260·3	514·19
Mature.							
Honesty IV of Cornwall Park	R. S. Allan, Hatuma	6	6	350·0	365	13,957·2	502·05
		AYRSHIRES.					
Two-year-old.							
Maesgwyn Joy ..	C. Morgan Williams, Ohoka	2	194	259·9	365	12,056·2	478·62
Maesgwyn Starlight	C. Morgan Williams, Ohoka	2	337	274·2	365	10,132·4	410·20

Second-class Certificate.

FRIESIAN.

Junior Two-year-old.							
Rosevale Model Keyes	North and Sons, Omimi	2	89	249·4	365	14,515·4	572·64

African Redwing Partridges.—The opinion of the Board of Agriculture was asked recently as to whether any objection would be raised to the introduction of the African redwing partridge into New Zealand. The Board agreed that there was no likelihood of this bird becoming a nuisance to agriculturists, and decided to offer no objection to such introduction.

SEASONAL NOTES.

THE FARM.

SOWING OF GREEN FORAGE CROPS.

In nearly all parts of the Dominion November is the principal month for the sowing of summer and autumn green forage crops, both for the supplementary feeding of dairy cows and the fattening of sheep and lambs.

For rape, if the land is dirty, it is good practice to sow in drills 21 in. to 28 in. apart and intercultivate. By this method the land is well cleaned, and heavy crops of good feeding-quality may be obtained. Seeding will range from 2 lb. to 3 lb. per acre, with from 2 cwt. to 3 cwt. of fertilizer. Generally freezing-works mixtures are considered very suitable for rape, and they give big yields, but in moist seasons rather much leaf is produced and the crop does not ripen as quickly as desirable, the nitrogen content doubtless accounting largely for this. Many farmers complain that they get heavy crops but very poor fattening results. Practice goes to show that a pure phosphatic manure such as super and Ephos, super and Nauru, or basic super, while not growing such a leafy crop as a mixture containing nitrogen, produces a much better fattening-crop. The heavy leafy crop is all right for dairy cows, but the shorter, firmer one is better for lambs.

For cow-feeding Buda kale is preferable to rape. It is not so heating, and the subsequent growths are quicker. The same rate of seeding and manure recommended for rape will do for the Buda kale. Thousand-headed kale also has many good qualities as a forage crop.

In many districts, notably in Otago and Southland, chou moellier has proved an admirable crop for dairy cattle and sheep. It does not bloat cattle nor impart taints to milk. Further, although a member of the Brassica family, it is not affected by club-root to the same degree as turnips, a point much in its favour. Sown at the beginning of November this crop under usual conditions will be available for feeding off during February. It should be sown in 28 in. drills by the turnip-machine, at the rate of 1 lb. of good germinating seed per acre. Thinning has to be resorted to in order to give the plants plenty of room for development, and a distance of at least 14 in. between the plants should be allowed. The use of a mixture of 1 cwt. superphosphate and 1 cwt. finely ground rock phosphate should give good results. Intercultivation between the rows is necessary to obtain freedom from weeds.

Field-cabbages, especially of the Drumhead variety, are well worthy of trial for autumn and winter feeding. Excellent results have been obtained from them in the South. On club-rooted ground this crop would prove very susceptible to the disease, and consequently should not be sown in such land.

Maize may be sown when danger from frost is past. The Ninety-days variety is among the best for green feeding, sown at from 1½ to 2 bushels per acre. Suitable manures are those recommended for rape, at the rate of 3 cwt. per acre. Seed should be buried at least 1½ in., and guarded so far as possible against birds.

Japanese millet is a good fodder crop for cows and sheep, and should be given a trial in districts where rape does not do well. It requires a sheltered position to give good returns, and should not be sown too early—any time after the middle of November in the warmer districts, and the first week in December in colder situations. Sow through every coulter of the drill 16 lb. to 20 lb. of seed, and manure with superphosphate at 2 cwt. to 3 cwt. per acre. To get the best from millet feeding should start when the growth is 6 in. to 9 in. high, and the crop should be fed off in breaks. Treated thus it will give a number of feedings.

In tests of millet against rape for lamb-fattening the former has shown up very well, in several cases lambs having shown a bigger gain per head on the millet (see special article elsewhere in this issue). On the other hand, a good crop of rape will in a good season fatten more lambs per acre than the same area of millet. If not ready to start feeding millet when a few inches high it may be allowed to grow up to 18 in. or more and then be fed. So long as it is not allowed

to seed it will make a second growth. Where there is doubt about the rape crop it is good practice to drill $1\frac{1}{2}$ lb. rape and 12 lb. of millet per acre. If both come away well there is a good mixed crop of splendid feeding-value, and if the rape fails the millet will give good forage. If a millet crop is not required for grazing it may be cut for hay or ensilage.

Peas for sheep-feeding may still be sown on the heavier land. Good varieties are Grey Partridge or Blue Imperial, sown at the rate of 3 bushels per acre. Superphosphate or basic super is a suitable manure for late-sown crops.

TURNIPS AND CARROTS.

Sowing of turnips will be one of the chief field operations in November, especially in the mixed-farming districts of the South, and attention should be paid to securing the best of seed. On club-rooted country an endeavour must be made to grow turnips only on land free from this disease. In order to get the crop well away out of reach of the fly it is important to work to a fine seed-bed and use a good dressing of quick-acting manure, such as a mixture of basic super and blood-and-bone. For early use Mammoth Purple-top is a good variety of soft turnip, but where the crop is to stand any length of time Green Globe and Red Paragon are better. The Green Globe variety keeps better than the Red Paragon.

Where turnip-growing is practically out of the question the growing of carrots should be considered. White Belgian, Matchless White, and Sinclair Champion are varieties worthy of trial, and should be sown at the rate of from 1 lb. to 2 lb. of dressed seed per acre. The ordinary method is to sow in drills 14 in. to 28 in. apart. For milking-cows the carrot may be considered superior to any other root crop.

In connection with root-growing, there is now on the market a one-horse single-disk ridger well adapted to the requirements of the average dairy-farmer who crops to a limited extent only.

LUCERNE.

Usually the weather in November (in the North Island at least) is not suitable for making hay, and the better proposition is to put the first cut of lucerne into ensilage, or feed it out green to cows and pigs. Lucerne cut towards the end of November should be ready to cut again early in the New Year, when it may be harvested for hay or fed out green. Lucerne is required at different times and for different purposes to suit varying conditions of farm and situation, and a great deal can be done to regulate this by means of the spring cuttings. Although it is recognized that there is a proper time for cutting lucerne—just when the new growth is coming away—it will not impair the stand if cutting is delayed for a time; in fact, the subsequent growths will often be more vigorous.

Areas that are being prepared for sowing in lucerne this year should have frequent cultivation to germinate and destroy weeds. In the drier and warmer districts November is a favourable month, but in exposed or cold situations sowing is better delayed until December. If the land has not been limed and carbonate of lime (crushed limestone) is to be used it should be applied at once. Burnt lime is best applied just before the seed is sown. Give at least 10 cwt. of carbonate or 5 cwt. of burnt lime per acre. Seed at the rate of 15 lb. per acre, and sow through every coulter of the drill, or, what is better, drill half the seed one way then cross-drill the remainder. The next best method of sowing is broadcasting after the Cambridge roller. The seed-bed should be well rolled and firm. Inoculated soil is usually necessary, a suitable quantity being about 3 cwt. per acre. Alternatively, the seed may be dressed with Farmogerm. Superphosphate or basic slag are the most suitable manures, but any phosphatic manure will give good results if applied at from 2 cwt. to 3 cwt. per acre. The requirements for obtaining a good stand of lucerne are clean land, fertile soil, a firm seed-bed, and favourable weather to germinate the seed. The Marlborough strain of seed is to be recommended.

PLOUGHING AND FALLOWING OPERATIONS.

Under Canterbury and North Otago conditions any land intended for summer fallow should be skim-ploughed as soon as possible. Rape and turnip land after green feed should be ploughed and worked down. Towards the end of November twitch-infested land should be ploughed to a depth that will just go beneath the twitch layer (probably about 4 in.), and when this furrow has dried out considerably the land should be cross-ploughed to the same depth. In this way large rough

hunks are left to dry out in the north-west winds, and most of the twitch will be destroyed. This method is preferable to skim-ploughing and grubbing, as the latter method consolidates the ground beneath the surface, and any piece of twitch that may have been missed will re-establish.

PASTURE-MANAGEMENT.

Pastures will now require the greatest care in grazing, so that the luxuriant early-summer growth is not allowed to become rank and unpalatable through insufficient stocking. The advantages of good subdivision of the land into comparatively small areas is well demonstrated by the finer sward and more succulent growth of those paddocks, which can be fed down quickly whenever necessary. Should the feed show signs of getting ahead of the stock it is a good plan to shut up one or more paddocks and cut them for ensilage. This can be done even in showery weather, and will not only save waste, but will greatly improve the succeeding herbage. Stock of all kinds relish a change on to fresh young grass.

The management of pastures is a phase of farming which perhaps requires special attention in Canterbury. Owing to the heavy local north-westers and moisture conditions generally, combined with heavy stocking during the spring months, pastures usually present a poor appearance about January, and even on the better land do not hold so long as they should. Spelling of grasslands should be practised to a greater extent—firstly with the object of allowing the better grasses to reseed, and thus re-establish the pasture ; and, secondly, because a certain amount of feed, though somewhat dry, will be preserved for use later in the season.

—*Fields Division.*

BRANDING OF SHEEP.

Immediately after shearing all sheep should be carefully branded with the registered brand of the owner—that is, in all districts which are not exempt from wool-branding. It is noticed that a number of owners brand in a very careless manner, the oil or paint used not being of the proper consistency and simply making a blotch. Section 62 of the Stock Act states that all sheep shall be distinctly and legibly branded with the owner's registered brand, and for every such sheep not so branded the owner shall be liable to a fine not exceeding 10s.

In the case of stragglers or sheep shorn by mistake, these should be branded on the head with the registered brand of the owners in whose shed the sheep have been shorn, or, if he has no registered wool-brand, with a distinguishing mark of paint or tar. Failure to observe these rules is often the cause of bad feeling between neighbouring owners, and sometimes ends in Court proceedings.

All lambs should be branded not later than 30th April in each year.

—*Live-stock Division.*

THE ORCHARD.

FRUIT-TREES of various descriptions will now be in the summer stages, with young fruits and heavy growth of foliage. The fruits advance very rapidly in size, necessitating repeated sprayings to keep them protected against attacks from insect pests and the multitude of fungus spores. The same applies to foliage, which is of quite as much importance to the welfare of the tree as the production of fruit is to the grower. Every effort should be made to keep the foliage as healthy as possible. Unless the fruit and foliage are kept well covered disease-prevention is almost impossible, yet this must be done in such a way as to eliminate russet, burning, or other damage to either fruit or foliage.

SPRAYS AND SPRAYING.

Arsenate of Lead is used for the control of biting and chewing insects such as codlin-moth, leaf-roller, cut-worms, &c., and is used at the rate of 2 lb. (if in powder form) or 3 lb. (if paste) to 100 gallons water. To ensure the best results being obtained it is essential that all parts be thoroughly covered with the spray. With the rapid new season's growth this means repeated applications of not longer than twenty-one-day intervals.

Bordeaux Mixture (3–4–40) is used for the prevention and control of fungus diseases. As a summer spray for fruit-trees bordeaux should be used with the utmost caution, owing to the liability of damage to fruit and foliage. Never in any circumstances should it be used unless tested and proved to be alkaline. It is not really necessary on apple and pear trees except for black-spot control, and should be used only when spot is either feared or present. Before application arsenate of lead may be added to bordeaux.

Lime-sulphur is used for the prevention and control of fungus diseases, young scale, mites, &c. There are many forms of this solution, from home-made to the many brands of commercial manufacture. The solution varies in density according to manufacture, and should be tested for specific gravity in order to permit correct dilution. Recommended dilutions are always based on 33° Beaume. Whatever brand is used purity should be the main consideration first and every time, and concentration only a guide to dilution. A false concentration test can easily be established by adulteration with salt or sugar, both of which cause damage to the trees and crop. Use at a dilution of 1 gallon to 100 gallons water for pip-fruits, or 1–125 for stone-fruits, and apply sufficiently often to keep the growth covered. Lime-sulphur may be used in combination with arsenate of lead, but when so mixed a free acid is formed which must be neutralized by the addition of lime, or burning of foliage will take place; 3 lb. of lime per 100 gallons will suffice.

Atomic Sulphur is used in particular for the control of powdery mildew, but is a very useful supplement to lime-sulphur for the control of brown-rot, and tends towards improving the texture of the foliage. When used alone 10 lb. per 100 gallons is correct; when in conjunction with lime-sulphur 4 lb. to 6 lb. per 100 gallons. It may be applied with arsenate of lead and lime-sulphur plus lime.

Nicotine (40-per-cent. extract) is used for the destruction of aphis, leaf-hopper, &c., applied at the rate of 1 pint per 100 gallons. It may be mixed with arsenate of lead, lime-sulphur, and atomic sulphur, or the whole combined plus lime. If used as a single spray a spreading-medium is required, such as soap, 3 lb. per 100 gallons.

The present seasonal uses of the sprays would be as follows :—

Pip-fruits—Arsenate of lead, 2 lb. powder to 100 gallons; lime-sulphur, 1 gallon to 100 gallons; plus lime, if mixed, 3 lb. to 100 gallons (all three every 21 days); plus atomic sulphur, 4 lb. to 100 gallons, if variety is subject to mildew; plus nicotine, 1 pint to 100 gallons, if hopper or mealy bug are present. Bordeaux 3–4–40, alone or in combination with arsenate of lead.

Stone-fruits—Lime-sulphur, 1 gallon to 125 gallons water; plus atomic sulphur, 6 lb. to 125 gallons water (one application of each during November); plus nicotine, 1 pint to 125 gallons water, if aphis is present.

CULTIVATION.

Cultivation of the land should be continued. Where the land is heavy for the cultivator a very shallow ploughing may be done, but the land should not be left rough any longer than necessary.

THINNING.

Now that crops can be estimated, thinning may be done. Even where the crop is light it pays to remove all fruit from one- and two-year-old leaders in the interests of growth, and to reduce the number of fruits per cluster in the interests of thorough spraying and cleanliness of fruit. With a medium to heavy crop thinning pays every time. This practice is recognized by the successful orchardist as most necessary. Thinning allows all misshapen, underdeveloped, diseased, or injured fruit to be removed, regulates the crop from year to year, reduces to a minimum the production of culls and minimum-sized fruits, permits better colour, ensures more freedom from blemish, and does not overtax the tree or land.

No hard-and-fast rule can be laid down as to the number of fruits allowed to remain on the tree; all is governed by the circumstances of tree condition, land, &c. As a general rule, all fruits should be removed from one- and two-year-old leader wood, all clusters reduced to singles, or at most doubles, and fruits removed from the extremities of unstable lateral wood.

—*W. H. Rice, Orchard Instructor, Hastings.*

CITRUS FRUITS.

At this period citrus-trees should be showing considerable activity, especially those that have suffered in any way severely by frost damage; and as warm weather will have caused scale and other sucking insects to be on the move it is desirable that control measures be adopted at this juncture. For this purpose the prepared red oils are recommended as a spray, to be used at the rate of 1 part of oil to 40 of water. Owing to the difficulty at all times experienced in covering the under-part of the foliage of citrus-trees with spray material it will be found advantageous to adopt the use of a spray-gun for this work. The larger number of the young scale insects may generally be found on the under-side of the leaves alongside the leaf-rib, and these must be reached if effective control is to be obtained.

As citrus-trees that have been frosted come into activity growers will be enabled to see what portions of the damaged wood it is necessary to remove. Good clean cuts should be made when this work is undertaken, cutting to an outside shoot in each case.

Growers are advised to use those brands of red oil that have proved effective, rather than experiment with oils the qualities of which are, as yet, an unknown quantity.

STRAWBERRY-GROWING.

Fruit should be harvested immediately it ripens, not only to save depredations by birds, but also to prevent the taking of too much nourishment from the plant. Where necessary, spraying with Burgundy mixture for the control of leaf-spot may be continued, but it is not advisable to use this spray more often than is absolutely necessary. Watch for the appearance of runners, which should be pinched out during the fruiting season, before they grow too long and thus take nourishment from the plants.

Unfortunately, during the last few seasons a very unsatisfactory method of marketing strawberries has been adopted by quite a large number of the growers in the Auckland District—namely, the practice of "topping up" the chips with larger berries than those which are contained in the lower parts of the container. This is to be discouraged in any shape or form, and it is hard to realize how producers can be so blind to their own interests as to continue the practice, which must necessarily reflect back to them from the consumer.

FIREBLIGHT.

Any infection from this disease should be showing up at this time, and it is necessary that the very keenest lookout should be maintained, so that the diseased parts may be detected and immediately removed and burnt as already directed in previous notes.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

THE EXPORTATION OF EGGS.

WITH the object of ascertaining whether a payable outside market exists for New Zealand eggs when there is an excess over local requirements, the New Zealand Poultry Association arranged for two trial shipments of eggs to be sent to the London markets this season. The first consignment was shipped by the s.s. "Corinthic," which left the Dominion on 20th September. This comprised 1,580 cases of fresh eggs of thirty dozen each, six cases of preserved eggs, and about 2 tons of egg-pulp. The s.s. "Rotorua" left with the second shipment of about 2,000 cases on the 13th of this month. These shipments have been made up by various egg societies at Auckland, Wellington, Christchurch, and Dunedin. The South Island quota will be disposed of under the supervision of Mr. J. B. Merrett, late secretary of the New Zealand Poultry Association, who accompanied the first shipment. The North Island quota has been consigned to reliable agents for disposal.

The eggs are packed in standard white-pine cases, with special cardboard fillers and flats. Woodwool pads are also used, one being placed on top, bottom, and centre respectively of each case; these act as cushions to prevent jarring

and breakages. The case is made in such a way that there is free circulation of air through it at all times. The eggs are carried in a special chamber at a temperature of about 34° F.

It was realized that if these eggs were to hold their own against other competing countries a high standard of quality was the first essential. There being no regulations to enforce compulsory grading, an arrangement was made between the Department of Agriculture and the Poultry Association whereby the whole of the grading, testing, packing, &c., was carried out under the supervision of the Department's Poultry Instructors. As the eggs came from the producer they were first unpacked and graded. All eggs found to be under 2 oz. in weight, or with dirty shells or of bad shape, were rejected. The good eggs were then passed on for testing. The testing is carried out by placing the egg before a strong electric light, which is contained in a small box. In the latter there are two apertures barely the size of an ordinary egg. The operator takes an egg in each hand and places them before these apertures. By this means the internal quality can be at once detected. All eggs with large air-cells (indicating staleness) are rejected, while addled eggs or those containing pale yolks or blood spots are also discarded.

By this examination it was ensured that the eggs contained in these trial shipments were of excellent quality, good size, and clean and inviting in appearance. In addition they were carefully packed, while the case itself bore a well-got-up, attractive appearance. The loading on board ship was carried out in a most careful manner by those in charge of the work. Therefore, if the eggs retain their good qualities during transit in the cool chamber, there should be everything in favour of their opening up at their destination in a satisfactory condition.

The next question, and one which is of the greatest importance, is whether or not the experiment will prove a financial success. Information bearing on this matter will be anxiously awaited by poultrymen generally.

It is pleasing to note that the egg-circle agents and others who were entrusted with the arrangements for the shipments on behalf of producers at the four centres did everything possible to help myself and assistants in having the work of grading, &c., carried out to a high standard. One of the worst features in connection with the work was the large number of inferior-quality eggs sent by producers to the collecting-depots. With a view to eliminating weaknesses likely to crop up in this respect, the Department recently issued a bulletin (reprinted from the *Journal* of July last) setting forth in a clear manner the class of eggs required for export and those that were unsuitable. This bulletin was distributed gratis to producers, but, judging by the very large number of poor eggs sent forward to some depots, it is questionable if many even took the trouble to read it. Unfortunately, the trouble was not confined to a few producers, but to all but a small minority. Some shocking examples of how not to market eggs were observed when sorting out the various lines. For days it was not uncommon to see from 50 to 70 per cent. of the eggs that came forward rejected, chiefly because they were undersized, stale, or in a dirty condition. It must be admitted that few overripe eggs were sent in, so that the great bulk of the rejected eggs were quite fit for human consumption. Some allowance might be made for a few small eggs finding their way to the collecting-depots, but there is no reason whatever, except carelessness on the part of the producer, for the large number of dirty-shelled eggs that came to hand. Thousands of eggs of the desired size, and wholesome in every other respect, had to be rejected for no other cause. Yet it is safe to say that, with few exceptions, they were deposited by the hen in a clean, fresh condition. Of course, all poultrymen were not alike in this respect so far as the export eggs were concerned, for at each centre lines of eggs were to be seen which were a credit to the producer. It was a pleasure to handle such eggs. Indeed, some lines were so good that with the exception of an odd egg containing a blood spot or a crack (which was no fault of the producer) the whole of the eggs in the line were ready for packing in the export cases. This is how it should be.

Another unsatisfactory feature of the whole business is that the cost of handling, such as unpacking, testing, grading, &c., must be borne by the smaller margin of eggs passed for export. Mistakes—indeed, costly mistakes—have been made which cannot be rectified now, and care should be taken that these are not repeated. If one man can send forward his eggs in a well-graded, clean condition, then surely others can do likewise. If further shipments are to be made, each producer must be made to realize his responsibility. Above all, he should be made to understand that the work of removing dirt from his eggs should be done at home

and not at a grading-depot. Some breeders even went so far as to send in eggs that had failed to hatch in an incubator.

During the process of grading, testing, &c., many persons visited the depots and took a keen interest in the work. Unfortunately, however, the work was not witnessed by many of those requiring the lesson most—the producing community. Had the various poultry organizations arranged gatherings of producers it would have no doubt served a most useful purpose by letting the careless poultryman judge for himself his own methods of marketing as compared with the methods of those who market their produce in a proper manner. Many breeders are pinning their faith to an export trade as a means of relieving the summer surplus, and rightly so, but it should be remembered that the critical oversea markets will not pay full rates for undersized and inferior-quality eggs. Only the best will warrant the export business. Especially is it necessary to remember quality in initiating a trade.

Another point that should be borne in mind is that the freight of eggs is based on space measurement, which the producer must in the long-run pay. The export case and fillers are made to hold thirty dozen 2 oz. eggs or slightly over. It is therefore poor business to send undersized eggs abroad, in view of the fact that the larger product is of much greater value. Particularly is this so in these days of high freight charges.

ACTION BY THE EGG-LAYING COMPETITION EXECUTIVES.

The egg-laying competitions have rendered the industry excellent service in developing the laying-power of certain breeds of poultry, but those who control them have realized that the number of eggs produced should not be the only object. It is now recognized that the weight of eggs laid by the respective pens in the competitions is of equal or greater importance than numbers. It is interesting to know the weight of eggs produced by competing pens. These figures disclose valuable data, clearly indicating specialists' stock that fail to lay the required weight of egg. The management of the different competitions are to be congratulated on not allowing prizes to be won by birds laying a second-grade product, and it is only by this means that the egg-standard will be raised throughout the Dominion. The eggs sent from the laying competitions to the export depots were a picture to look at, being of good size, clean, and fresh.

THE LOCAL EGG-MARKET.

The unsatisfactory manner in which so many producers sent in their eggs for export (not only the small producers, but big ones as well, the latter in many cases being the worst offenders) obviously points to a weakness in the system under which the local trade is catered for. It was sufficient, indeed, to indicate that the marketing of eggs calls for urgent reform from one end of the Dominion to the other. Under the present crude pooling-system by which eggs are generally marketed there is no encouragement to the producer to go to any special trouble in breeding birds to lay good-sized eggs, or to market them in the best possible condition, simply because these supplies of a high-grade quality article have to be sold at the value of the unsatisfactory lines. Usually it is the eggs of the latter class coming on the market which set a low value for eggs in general. Obviously the consumer will not be keen for them, so the price has to be reduced, perhaps a second and third time, till the rate is so tempting that sales are effected.

One of the best means of encouraging a greater local consumption of eggs will be by the institution of a system of grading and testing every egg before it reaches the consumer, as has been done in the case of eggs for export. If the various egg-circles operating in the Dominion are really anxious to build up a high-class local trade, which would be of real benefit to both the consumer and producer, they must have regard to this feature. The day is passing when the consumer will purchase eggs irrespective of quality. He will rightly demand that they be fresh, clean, and of a certain weight. The necessity, therefore, of defining a first- and second-grade egg for the local market becomes a matter of prime importance.

It is gratifying to note that at least some of the Wellington grocers have adopted the principle of selling eggs according to their weight. They are sold by count as formerly, but they are graded to size. This ensures that each grade is of about the same relative value so far as weight is concerned. This is how

it should be. Under the present general system of disposal by the dozen quite irrespective of their weight the purchaser must frequently, if not always, pay too much for small eggs and too little for large ones. For example, it is common to see lines of eggs in shop-windows ranging from 1½ oz. to 1¾ oz. and ticketed up at, say, 2s. a dozen, whereas probably in the next shop 2 oz. eggs and over may be seen marked up at exactly the same figure. Recently a poultry-keeper brought to the writer a line of eggs which scaled 30 oz. to the dozen, or 2½ oz. each. He declared that in a wholesale way he got no more for this class of egg than the average line of 1¾ oz.

It has been decided that no egg under 2 oz. in weight can be considered as a first-grade exportable article, and here the question arises, Why should there be one grade for export and another for local consumption? If it is necessary to specially define what a first-grade egg should be in order to work up a successful oversea trade, then surely it is of equal importance to do likewise for the local market. The local consuming public is prepared to pay a good price for a good quantity and quality egg, but they cannot be expected to pay top prices for eggs of doubtful quality. It is only when the central egg-collecting depots resort to the grading and testing of eggs, as is being done for export, that the local market will be placed on a sound footing. It is at these places that, after being tested and graded, the eggs should be stamped according to their grade and guarantee of quality. Under the present general system of organized control the producer applies the brand of the circle and his individual number, but this is next to useless as a guarantee of quality, as in too many cases the eggs are placed in the carriers just as they come from the nest, without regard to cleanliness or distinction as to size and colour. It would be interesting if some cases of eggs as packed for export were displayed in one of the shop-windows of a leading grocer and offered for sale for preserving purposes. It is safe to say that such guaranteed quality would easily realize from 2d. to 3d. a dozen over ordinary market rates.

It is to be hoped that at the next conference of the New Zealand Poultry Association steps will be taken to place the marketing of eggs on a more satisfactory footing. The egg-laying competitions are making a special effort by means of weight clauses to increase the size of eggs produced in these tests. It now rests with the egg-circle movement to take up the matter in a similar manner by defining what a first-grade egg really is, and seeing that the market rate is based on this and not on the doubtful article.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FEEDING AS A SAFEGUARD.

In many districts there is a distinct break in the honey-flow from the cessation of the willow and fruit bloom until the clover makes its appearance. It is during this period that the bees must be carefully watched, not only to see that they are not dying of starvation, but also to provide for a sufficient increase in young bees which will develop into field workers by the time the main honey-flow arrives. Gently stimulative feeding is the best course to adopt at this period. The quantity of syrup fed will depend largely upon the strength of the hives. If feeding has to be resorted to the sugar-syrup may be fed in a less concentrated form than that which is given in the autumn and spring months, the quantity of water being increased. A syrup fed in the proportion of one of sugar to six of water is all that is required, and will be the means of keeping the colonies strong in brood and bees. The invariable rule should be observed always to feed in the evening and inside the hive.

VENTILATION.

No set time can be given for increasing the size of the entrances, but the action of the bees should be noted. If where the entrances to the hives were contracted in the autumn to prevent the intrusion of mice they have not been already widened, they should be attended to at once. Proper ventilation during the working season is an important item in bee-management, as it relieves large

numbers of workers from the duties of fanning during the hot weather. In extreme cases it may be necessary to elevate the hive-body by placing 1 in. blocks between it and the bottom-board. This should be sufficient to meet all requirements.

SUPERING.

Preparations should be well in hand for enlarging the hives. This may be done when the brood-chamber is getting full of bees, and the operation should be carried out in mild weather. Do not wait until the bees are cramped for room, but anticipate their wants and add supers when they are required. Where drawn-out combs are used no trouble will be experienced in inducing the bees to enter the supers. It often happens that no combs are available, in which case sheets of foundation must be used; but the bees will not always take readily to these unless there is a good flow of honey coming in, and a little encouragement will have to be given to induce them to enter the supers when only foundation is used. Should the bees fail to start work in the supers, elevate one or two frames of honey from the brood-chambers, at the same time inserting in their place sheets of foundation from the super. Do not bring excluders into use at this season, as the bees will rarely work foundation in the supers when they are used. Much time is lost by this practice, and very little honey will be gathered.

TREATMENT OF FOUL-BROOD.

As advised last month, beekeepers should not fail to treat all cases of foul-brood as soon as settled weather conditions prevail. Nothing is to be gained by postponing treatment, and the earlier the infected colonies are dealt with the more likelihood there is of their working up to strength for the main crop. Generally the weather is settled enough in the latter part of November for undertaking treatment in all parts of the Dominion, and usually the clover is yielding sufficiently to enable the beekeeper to carry out the work with a minimum amount of feeding.

At every inspection of the hives the condition of the brood should be noted. If any of the capped cells appear to be different from the rest an examination of the cells should be made to ascertain the cause. The cappings of healthy brood are bright, fresh, and convex in form, whereas those attacked by foul-brood are darker, flat, and easily distinguishable from healthy brood by their blackish-brown colour. In the early stages of the disease on opening the cells a gluelike coffee-coloured mass will be noticed, and on the insertion of a splinter of wood the rotten mass will rope out some little distance from the cell. This ropiness is a true test for foul-brood. In the more advanced stage the disease is not so readily detected, because the rotten mass has dried upon the bottom of the cell in the form of a black scale. Generally, Italian bees will open the cells more readily than Blacks and remove the cappings, rendering it much more difficult for the beginner to detect the disease; but even though the cappings have been entirely removed the scale is easily detected on the base of the cell by holding the comb so that the light will pass over the shoulder into the cell.

Other indications of the disease in the advanced form are ragged perforations and a characteristic bad odour which is emitted. When the odour can be detected on opening up the hive the latter should be destroyed at once, remembering that the treatment of such colonies is only a waste of time, and it is by far the best policy to use drastic measures. When the disease has reduced the condition of the colonies until there are only a few bees left it is useless and dangerous to undertake treatment, and much the safest plan is to destroy the hive and contents as it stands.

Many new systems of treatment have been put forward, but with little success, and the beginner would be wise to discard any but the McEvoy treatment, which has been successfully used the world over. If it is properly carried out failure to eradicate foul-brood is almost unknown. When treatment has to be undertaken it should be carried out, if possible, in the evening, when the bees are quiet, there being then less risk of spreading the infection to other clean hives in the apiary. In cases where the hives are close together it is safer to close the entrances of the immediately adjoining hives.

To carry out the treatment prepare a set of frames fitted with narrow strips of foundation, and put these into a clean hive. Shift the diseased hive to one side, and place the hive fitted with these "starters" in its place. Remove the combs one by one, and shake and brush the bees into the prepared hive. When

the bees are removed put the diseased combs into a spare super and cover immediately. Remove all parts of the infected hive and combs to a place of safety out of reach of the bees. In four days' time the operation of removing the "starters" must be undertaken, when in their place frames fitted with fresh sheets of foundation are substituted. Shake the bees off each of the starter frames, and insert the frames containing full sheets of foundation. The comb built from the starters must be cut out and melted up. The object of the treatment is to induce the bees to use up the infected honey taken from the old hive, so that when they are given the second shaking they start clean.

It may happen that the bees will swarm out when given the second shaking. To prevent this either cage the queen, or, better still, place a piece of queen-excluder in front of the entrances. This will prevent the queen from leaving, and all will be well.

A further examination should be carried out in three weeks' time to note the condition of the brood. If disease reappears after treatment do not start tinkering with the brood by cutting out isolated cells. This practice is dangerous, and although often advised is misleading. A much better plan is to remove the entire comb, or, better still, make use of a modified form of the McEvoy method. In place of shaking the bees on to strips of foundation starters for four days, the bees are shaken on to nine sheets of foundation and an empty bone-dry comb, this being inserted in the centre of the hive. At the end of twenty-four hours the comb can be removed and a frame containing a sheet of foundation put in its place. This operation should be performed quickly and quietly, with the use of very little smoke. The object of inserting the dry comb in the centre of the hive is to induce the bees to store the honey which they took from the diseased hive when shaken.

Treated colonies: If bad weather sets in a strict watch should be kept over treated colonies to prevent them from starving out. Feed sugar-syrup in the proportion of four of water to one of sugar. Feeding should be kept up until the bees are gathering nectar freely.

—*E. A. Earp, Senior Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

As the new season's vegetables and fruit come in the rhubarb and asparagus beds should be given a rest and allowed to complete their growth. It is often advisable to assist them now with a good dressing of suitable fertilizer.

Complete the sowing of hardy main crops—carrots, red and silver beet, &c.—and keep all seedlings well thinned and hoed.

The seeds of pumpkin, marrow, cucumber, and melons may be sown as soon as the danger of late frost is over. They prefer a warm, moist, well-drained locality. Plant 6 ft. to 10 ft. apart, about six to eight seeds in a clump, first making a slight depression. If, after planting, a sheet of glass is laid over clumps of the more tender kinds it assists germination and keeps away birds, which are often very troublesome.

In localities which are sufficiently warm the kumara (sweet potato) may now be planted out. Space the plants a little wider than the ordinary potato.

Winter crops, such as broccoli, savoy, cabbage, leeks, and celery, may be sown now for planting out early in the new year.

Maintain a supply of salads and spinach by repeated sowings at short intervals.

Tomatoes.

In most districts tomato-plants may be planted outside now. To get an early crop the plants must be strong, well rooted, and hardened off; avoid plants that are stunted and crowded in the boxes. While the ground should be well prepared, it must have settled down firm. The plant does best on rather a solid bed.

Under glass the first picking of fruit will probably be made this month. The ground should then be well mulched down, and occasional applications of liquid manure made. Keep the plants well secured to the strings and all laterals pinched out. Foliage may be trimmed from round the ripening bunch.

SMALL-FRUITS.

In many small-fruit sections the plants are stunted and poor; a great improvement would be shown if a dressing of the more soluble chemical fertilizers were given now. Usually this includes superphosphate, sulphate of ammonia, and sulphate of potash. The mixture should be broadcast between the rows and scarified in.

Cape gooseberries may be planted out now. Results will largely depend on the preparation given to the land. A good spacing is 3 ft. between the plants and 6 ft. between the rows.

THE FLOWER-GARDEN.

It is now time to plant out the half-hardy annuals, dahlia and chrysanthemum plants. The violet-beds will benefit and give a much better crop of blossom next season if a good dressing of chemical fertilizer is applied now. The foliage of many kinds of bulbous plants is inclined to be in the way and look untidy, but it should be carefully preserved. The plants are setting the flower-buds for next season, and should have every attention.

The proper use of chemical fertilizers is the secret of success in modern gardens. The soluble kinds make the feeding of plants with liquid manure an easy matter, but the application must be properly timed. For the different qualities and effects of the principal chemical fertilizers, see the article in the *Journal* for June last. An amount of 1 oz. to the square yard represents 3 cwt per acre.

Lawns and Lawn-mowers.

Grass lawns require regular trimming now to keep them in order. The work is often unsatisfactory owing to the mower being in bad order. It is either blunt or badly set. The principle on which the ordinary lawn-mower is made is that of a spindle of beaters revolving quickly on a fixed ground plate or knife. There are set-screws at each end of the spindle to enable one to adjust it to the fixed knife. The adjustment should be even, and sufficiently close to cut paper cleanly when placed between.

To sharpen the mower place it upside down on a bench and arrange the mechanism to enable the beaters to revolve the opposite way. By revolving the beaters in this way and wiping them occasionally with a mixture of emery-powder and oil they will quickly improve. Finish with knife-powder and oil to give a fine edge; then wipe them clean and reset the machine. Machines are made with facilities for sharpening them in this way.

—*William C. Hyde, Horticulture Division.*

CLASSIFICATION OF SOILS BY PLANT-FOOD PERCENTAGES.

THE following tables, representing European practice, will assist readers in interpreting chemical analyses of soils as given, for instance, in the article "Some Soils of Otago Peninsula" printed elsewhere in this issue.

Maercker's Rating (Hydrochloric-acid Extract).

Grade of Soil.	Total Phosphoric Acid.	Total Nitrogen.
Poor	Below 0·05	Below 0·05
Medium	0·05–0·10	0·05–0·10
Normal	0·10–0·15	0·10–0·15
Good	0·15–0·25	0·15–0·25
Rich	Above 0·25	Above 0·25

Rating adopted for Available Plant-food (Citric-acid Extract), as determined by B. Dyer's Method.

Grade of Soil.	Potash.	Phosphoric Acid.
Deficient	Below 0·005	Below 0·01
Normal	0·005–0·01	0·01–0·015
Good	Above 0·01	Above 0·015

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FARMING-PRACTICE ON PUMICE LAND.

"SPARRING FOR KNOWLEDGE," Rotorua :—

Is it good farming-practice on pumice soil of superior quality to burn off the fern and scrub, plough, and leave in that condition without a crop for twelve months or more ? Would it be better to plough tall fern under and leave it to decompose, also without seeding ? Is the basic slag at present on the market as efficacious as superphosphate on a pumiceous soil ? In the Taupo district turnips can be grown on virgin land on the first furrow, with little cultivation. Here, on a much better soil, this cannot be done without first growing clover. Why the anomaly ? What manure would bring about that much-desired result ?

The Fields Division :—

If the scrub you refer to is mainly light manuka you are advised to burn it with the fern and plough without delay as deeply as the soil will allow. Disk, harrow, and roll well, with a Cambridge roller if possible. Work up a good seed-bed and sow turnips. This crop can be put in about November or December. When fed off, work up the soil and put down grass about October. Tall fern can be treated similarly. If the scrub is chiefly heavy manuka it should be cut and later burnt. If this is done by February surface-sow with the following mixture : 3 lb. Italian rye-grass, 5 lb. perennial rye-grass, 4 lb. Yorkshire fog, 6 lb. Danthonia pilosa, 2 lb. Chewings fescue, 1 lb. brown-top, 2 lb. crested dogstail, 1 lb. white clover ; total, 24 lb. per acre. After a number of years the area can be ploughed, worked down, and sown in permanent pasture.

If you require fertilizers for top-dressing pasture a mixture of equal parts of superphosphate and basic slag gives good results on pumice soils. For sowing down pasture 2 cwt. to 3 cwt. of super is to be recommended. This dressing will give better results if the land has been limed. The slag on the market made by the Bessemer process is to be recommended. If you lime the soil, using 5 cwt. to 15 cwt. of ground limestone per acre, and use a mixture consisting of a good line of bonedust and super at the rate of 2 cwt. to 3 cwt. per acre, you should get satisfactory results on the first furrow with turnips. One part of blood-and-bone to two of super should be used. It must be remembered that pumice soils generally are deficient in nitrogen. A crop like turnips, following clover, will derive benefit from the humus added by the clover crop, which, apart from other benefits, supplies nitrogen. When clover precedes turnips it must be expected that the latter crop will benefit by the residue from the clover.

CASTRATION OF CALVES.

"CARDUUS," Marton :—

Will you please inform me as to the best method of castrating bull calves, and the age at which it is done ?

The Live-stock Division :—

Bull calves are generally castrated as soon as the testicles can be found in the scrotum, or purse. The method of castration is as follows : The calf is turned up in a sitting position and held there by an assistant. The operator then pulls the testicles down until the skin over them is stretched tightly. An incision is made at the lower end of the purse, over one testicle, which is then forced through the wound. The blood-vessels and the cord are then severed by scraping with the blunt part of the knife while still being stretched. This scraping prevents much bleeding. The second testicle is then removed in the same way, and a little carbolized oil applied to the wound, when the calf may be released.

PROPORTION OF CREAM TO MILK.

M. O'CONNOR, Timaru :—

Please advise me what weight of cream should come off a gallon of milk with a 4-per-cent. test, the test of the cream being 40 per cent.

The Dairy Division :—

Assuming that the milk is of average specific gravity, 1 gallon would weigh 10·3 lb. This gallon of milk, containing 4 per cent. of butterfat, would yield 1 lb. of cream containing 40 per cent. butterfat. This means that the fat lost in the skim-milk is equivalent under general conditions to that contained in the 0·3 lb. of milk.

DOG WITH SORE FEET.

B. B., Kai Iwi :—

I have a dog suffering from swollen and inflamed feet. If it is allowed off the chain the feet soon become quite raw. All four feet are affected. I have tried applications of tar and lard, and have kept the dog inside a shed, but there has been no improvement. Could you suggest any treatment ?

The Live-stock Division :—

Apart from many possible accidents, pricks, wounds, &c., the feet of dogs are liable to become sore after a long day's work ; the pads become worn, and the sensitive structures become hot and painful. For this, rest on clean bedding and bathing are essential. Hot boracic packs are useful. After bathing, the feet may be soaked in a mild alum bath, or, better still, painted with a little compound tincture of myrrh. Do not put the dog to work again till the feet have quite recovered.

APPLE POLLINATION.

A. L. FROST, Huapai :—

I would feel obliged if you would kindly let me know the best apple for pollinating trees of the McLiver's Winesap variety.

The Horticulture Division :—

Accepting the theory that any variety flowering at the same time will be an effective pollinator, any of the following varieties should answer : Salome, Delicious, Dougherty, Gravenstein, Dunn's. Dunn's is placed last in the list because it is inclined to be an alternate-year bearer, consequently there may be years when it will have no blossoms.

DEHORNING YOUNG CATTLE.

"ONETOKO," Tokomaru Bay :—

In regard to the dehorning of cattle, I understand that the use of caustic potash for treating calves is recommended. This, however, owing to the extreme care necessary in its application, is not always successful where one handles big herds on stations, as the calves have to be done at a certain age, which is not practicable. I fancy the best age is from fourteen to fifteen months—say, in October—using a dehorning-machine and applying Stockholm tar and kerosene, and taking a rim of hair off with the horn. I should be glad to have your advice in the matter.

The Live-stock Division :—

The time you state for dehorning the young beasts would be quite suitable. If using a dehorning-machine see that it is in first-class order before commencing. Use Stockholm tar as a dressing afterwards.

WEATHER RECORDS: SEPTEMBER, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

The month of September opened with strong south-west winds and cold and showery conditions, but was quickly followed by fair weather, and anticyclonic pressure held sway until the 9th, when northerly gales brought heavy rain, particularly in the northern districts. A westerly low-pressure then spread over the country, and, although during the last week of the month another anticyclone was located over the North Island, the barometer continued low in the South until the close. Two distinct westerly disturbances passed in the South, their troughs culminating on the 17th and 23rd. A cyclonic disturbance passed by the East Cape on the 18th, and was followed by another on the 20th.

The total rainfalls of the month were heavy northward of East Cape and Kawhia, and above the average in the Blenheim and Nelson districts, as well as at Greymouth, Hokitika, and Arthur's Pass; but elsewhere the totals were generally below the average of former years. There were some rather severe thunderstorms with hail in the North Island on the 23rd and 24th.

The weather may, on the whole, be described as dry, warm, and pleasant, and favourable to the rapid growth of grass and early-sown crops.

RAINFALL FOR SEPTEMBER, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	9·87	13	3·19	4·75
Russell	4·84	13	1·94	3·42
Whangarei	3·32	17	1·00	4·88
Auckland	4·00	22	1·24	3·63
Hamilton	3·86	21	0·96	4·37
Kawhia	3·70	17	0·54	4·39
New Plymouth	4·12	16	0·93	5·08
Inglewood	7·58	15	1·61	9·73
Whangamomona	4·68	19	1·28	7·57
Tairua, Thames	4·82	9	2·06	4·64
Tauranga	9·29	18	2·98	4·33
Maraehako Station, Opotiki ..	6·34	15	2·22	4·28
Gisborne	3·04	8	1·48	3·11
Taupo	5·82	14	2·16	3·71
Napier	..	..	..	2·29
Maraekakaho Station, Hastings ..	1·72	12	0·42	2·66
Taihape	1·70	14	0·40	3·72
Masterton	1·42	11	0·38	3·18
Patea	1·97	11	0·53	3·63
Wanganui	1·94	7	0·57	3·05
Foxton	2·27	10	0·83	2·38
Wellington	2·20	10	0·59	4·10
South Island.				
Westport	5·67	18	1·00	6·82
Greymouth	9·29	16	1·83	8·26
Hokitika	11·51	17	1·93	9·23
Arthur's Pass	15·17	11	4·10	14·96
Okuru, Westland	9·86	15	1·48	12·48
Collingwood	8·76	9	2·97	10·13
Nelson	4·53	10	1·76	3·75

RAINFALL FOR SEPTEMBER, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Spring Creek, Blenheim	2·95	9	0·90	2·64
Tophouse	4·61	15	1·25	4·81
Hanmer Springs	0·46	4	0·20	4·58
Highfield, Waiau	0·45	3	0·27	3·65
Gore Bay	0·94	6	0·39	4·28
Christchurch	1·42	8	0·49	1·75
Timaru	1·20	7	0·38	2·18
Lambrook Station, Fairlie	0·75	5	0·56	2·30
Benmore Station, Omarama	1·56	8	0·35	2·14
Oamaru	1·44	8	0·68	1·74
Queenstown	0·54	5	0·15	2·52
Clyde	0·25	6	0·10	1·06
Dunedin	2·07	11	0·80	2·75
Gore	..	..	..	2·44
Invercargill	1·78	15	0·36	3·03

DOMINION CROP STATISTICS: SEASON 1922–23.

Crop.	Area.	Yield per Acre.	Total Yield.
Wheat—	Acres.		
For threshing	275,775	30·44 bushels	8,395,023 bushels.
For chaff, hay, or ensilage	1,181	1·46 tons..	1,724 tons.
Not harvested (fed off, &c.)	1,731	..	..
Oats—			
For threshing	143,090	39·75 bushels	5,688,157 bushels.
For chaff, hay, or ensilage	302,216	1·59 tons ..	480,147 tons.
Not harvested (fed off, &c.)	23,622	..	..
Barley—			
For threshing	17,473	34·23 bushels	598,040 bushels.
For chaff, hay, or ensilage	428	2·11 tons..	901 tons.
Maize—			
For threshing	9,732	51·97 bushels	505,776 bushels.
For ensilage	739	5·73 tons..	4,231 tons.
Peas and beans—For threshing	24,449	28·53 bushels	697,548 bushels.
Linseed—For threshing	10,649	0·48 tons..	5,133 tons.
Rye-grass	34,850	391·22 lb. ..	13,634,187 lb.
Cocksfoot	13,431	146·76 lb. ..	1,971,135 lb.
Chewings fescue	10,365	225·22 lb. ..	2,334,386 lb.
Crested dogstail	6,423	196·11 lb. ..	1,259,613 lb.
Red clover and cow-grass	13,494	190·50 lb. ..	2,570,650 lb.
White clover	5,526	157·45 lb. ..	870,087 lb.
Other grasses and clovers	2,638	222·58 lb. ..	587,159 lb.
Grasses and clovers for hay, &c.	175,558	1·80 tons ..	316,573 tons.
Potatoes	20,197	5·64 tons..	113,825 tons.
Green fodder	249,417	..	..
Turnips	498,974	..	..
Mangolds	9,694	..	..
Onions	497	9·16 tons..	4,553 tons.

CORRESPONDENCE.

NESTING OF THE YELLOW-BREASTED TIT.

MR. EDGAR F. STEAD, of "Ilam," Riccarton, Christchurch, writes to the Editor:—

"I have read with interest the articles on 'The Relation of Birds to Agriculture in New Zealand' which have appeared in your *Journal* recently. Dealing with the yellow-breasted tit (*Myiomoira macrocephala*) the writers say that they know of no recent cases of this bird's nest having been built in orchards or gardens. With no desire to criticize the articles in question I would yet like to give my experience in so far as Canterbury is concerned.

"The 'tomtit' is one of the native birds that has undoubtedly increased here in the last ten years. As there is very little bush left in Canterbury, excepting on the hills, the tomtits, during the winter, frequent the large plantations and areas of scrub (mostly gorse, broom, lupin, &c.) on river-beds, and remain to breed. For the last four years they have come to my garden in the autumn, and on three occasions have bred here. Two years ago I decided to tame a pair which were here, and by collecting all the grass-grubs which the gardeners dug up, and feeding the tomtits with them, I at last got the birds to come freely to my hand for their food. They nested in the ivy which covers a eucalyptus in front of my house, but when the young were half-fledged a cat got the hen bird. (This, I may say, was the only cat I had ever willingly allowed to live here, and it is gone now.) The cock bird, however, aided by myself, reared the two young, and, after feeding them for three days in the top of a cedar, took them away with him early in November. In April of the following year he returned, and fed from my hand as before. He got a mate, and the pair were extraordinarily tame, taking grubs from the hands of complete strangers. They left, however, in September, and I never saw them again.

"Last winter a pair came, and, aided by previous experience, I quickly had them tamed. I then got a piece of firewood and nailed it up in the corner of my veranda, making what I considered to be an ideal nesting-site for a tomtit. On 29th August the birds decided that it was an ideal site, and commenced to build there. The first egg was laid on 10th September, and at date of writing the hen is sitting. She takes no notice of people moving about, or of any noises, or of the hall light, which at night shines through a fanlight on to the wall close by her nest. The cock bird collects all the food, and feeds her off the nest, though she occasionally still comes to me for food. As the cock bird frequently comes to my hand for a grub when he already has got food in his bill, I have been able to get a good idea of their food. I have seen him with caterpillars (all sizes from small ones up to fat greenish ones 1½ in. long), flies (including house-flies), millipedes, cockroaches, and spiders. As the nesting-site is quite safe from rats, cats, or stoats, I have every hope that the birds will safely rear their brood.

"As I have said, I do not write this to criticize the articles, but rather to amplify them on this particular point, and in the hope that perhaps some others may take to taming tomtits in their gardens, or, at any rate, giving them all the protection that such a wholly delightful and useful little bird deserves."

Orchard Registration.—The number of orchards registered during the financial year 1922–23 was 7,044, representing a total of some 30,000 acres. The amount of £1,982 was collected in orchard-tax.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner on 6th October: Peas—Partridge, quiet; Tasmanian ex store, 90s. to 100s. per quarter; New Zealand, 70s. to 82s. 6d. according to sample; English obtainable at from 55s. to 60s. New crop of New Zealand March/April shipment offered at 77s. 6d., but no business reported. Blue in poor demand; New Zealand afloat sold for £18 5s. per ton; forward shipments, £17 10s.; Tasmanian quoted at £20 to £21 ex store. Beans—English good quality selling at 43s. to 50s. per quarter ex store, but no inquiry for imported.

ANNUAL SHEEP RETURNS, 1923 (30TH APRIL).

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

Class.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams	538	926	3,243	580	3,586	1,989	10,862
Other rams	23,705	83,995	68,231	16,434	69,822	57,006	319,193
Wethers	209,827	486,322	562,336	204,711	483,795	604,636	2,551,627
Breeding-ewes	977,433	3,405,019	2,787,702	684,971	2,872,220	2,335,658	13,063,003
Dry ewes	51,566	230,667	172,054	46,132	152,562	164,951	817,932
Lambs	474,788	1,815,404	1,455,907	313,705	1,069,673	1,189,345	6,318,822
Totals, 1923	1,737,857	6,022,333	5,049,473	1,266,533	4,651,658	4,353,585	23,081,439
Totals, 1922	1,705,155	5,625,001	4,765,649	1,344,444	4,584,841	4,197,169	22,222,259

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1914–23.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Sheep of Distinctive Breed not entered in Flock-book, and Crossbred Sheep.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1914	321,869	229,055	13,526	170,169	734,619	3,211,661	12,691,121	1,152,749	7,008,613	24,798,763
1915	315,251	237,717	17,341	176,556	746,865	3,270,221	12,377,624	1,365,119	7,141,592	24,901,421
1916	316,131	252,201	15,012	175,155	758,499	3,478,263	12,640,566	1,189,023	6,721,799	24,788,150
1917	329,230	160,212	6,212	114,778	610,432	3,457,824	13,099,957	1,066,435	7,035,738	25,270,386
1918	325,111	171,437	6,297	125,116	627,961	3,696,520	12,850,597	1,592,452	7,770,772	26,538,302
1919	321,304	165,676	12,196	127,150	626,326	3,922,632	12,176,224	1,799,201	7,304,171	25,828,554
1920	306,621	154,516	9,803	109,454	580,394	3,901,742	11,415,159	1,814,391	6,208,284	23,919,970
1921	322,144	158,608	9,513	110,428	600,693	3,634,799	11,989,180	1,336,306	5,724,053	23,285,031
1922	322,072	154,277	7,259	98,221	581,829	2,727,624	12,341,777	952,789	5,618,240	22,222,259
1923	330,055	172,843	9,013	119,749	631,660	2,551,627	12,890,160	808,919	6,199,073	23,081,439

NOTE.—Stud sheep returned since 1917 are only those entered in Flock-books.

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS AND OF CROSSBREDS IN EACH SHEEP DISTRICT (1923).

Breed.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in Flock-book)—									
Merino	..	..	..	..	8,900	16,983	3,333	29,216	29,216
Lincoln	1,072	3,428	12,780	17,280	499	491	1,034	2,024	19,304
Romney	11,304	10,357	73,550	95,211	6,698	6,122	20,756	39,576	134,787
Border Leicester	588	..	754	1,342	260	9,859	12,326	22,445	23,787
English Leicester	454	665	383	1,502	1,201	19,907	763	21,871	23,373
Shropshire	248	35	102	385	183	2,300	391	2,874	3,259
Southdown	730	3,930	15,409	20,069	122	7,693	153	7,968	28,037
Corriedale	22	..	1,260	1,282	491	30,249	5,293	36,033	37,315
Other breeds	68	..	395	463	1,326	10,085	1,515	12,926	13,389
Totals	14,486	18,415	104,633	137,534	19,680	103,689	51,564	174,933	312,467
Sheep of a distinctive breed but not entered in Flock-book—									
Merino	11,980	15,163	31,377	58,520	182,160	408,843	282,376	873,379	931,899
Lincoln	10,421	64,154	42,857	117,432	5,011	5,318	14,374	24,703	142,135
Romney	240,279	1,163,610	1,012,363	2,416,252	156,482	79,676	312,829	548,987	2,965,239
Border Leicester	3,368	2,137	5,290	10,795	777	53,747	59,908	114,432	125,227
English Leicester	2,298	1,179	9,371	12,848	7,431	71,059	5,846	84,336	97,184
Shropshire	3,074	433	680	4,187	1,256	4,851	909	7,016	11,203
Southdown	1,980	13,541	26,659	42,180	206	5,850	17,113	23,169	65,349
Corriedale	386	243	33,545	34,174	13,642	357,294	254,728	625,664	659,838
Half-breds	2,383	181	1,284	3,848	196,281	832,112	282,062	1,310,455	1,314,303
Other breeds	1,532	781	961	3,274	2,077	32,377	3,051	37,505	40,779
Totals	277,701	1,261,422	1,164,387	2,703,510	565,323	1,851,127	1,233,196	3,649,646	6,353,156
Crossbreds and others not otherwise enumerated	1,445,670	4,742,496	3,780,453	9,968,619	681,530	2,696,842	3,068,825	6,447,197	16,415,816
Grand totals ..	1,737,857	6,022,333	5,049,473	12,809,663	1,266,533	4,651,658	4,353,585	10,271,776	23,081,439

CONTROL OF SHEEP-SCAB IN BRITAIN.

At the 22nd International Conference of Sheep-breeders, held at Newcastle-on-Tyne in July last under the auspices of the National Sheep-breeders' Association, the matter of sheep-scab in Britain was brought forward by the New Zealand delegates. The following resolution was carried: "That this international conference of sheep-breeders, at which delegates are present from Great Britain, Australia, Canada, South Africa, France, South America, Norway, Mexico, and New Zealand, wishes to call the attention of the Minister of Agriculture to the presence of sheep-scab in this country, and asks the Ministry to formulate means to ensure its eradication."

Subsequently the High Commissioner for New Zealand communicated with the (British) Minister of Agriculture asking his sympathetic consideration for the resolution, and expressing the view that the absence of scab in the flocks of Great Britain would be of benefit by facilitating export and giving purchasers a wider choice of flocks from which to select their stud animals.

A reply received from the Minister of Agriculture by the High Commissioner states that the question of the measures to be adopted with a view to the eradication of sheep-scab have for many years past received the close attention of the Ministry. In 1920 the whole policy of the Ministry in this connection was carefully reviewed. Until that date the measures taken had been based upon the recommendations of a Departmental Committee which reported in 1904. The principle of universal dipping of all sheep in the country in approved sheep-dips was at the time regarded as an aim the attainment of which would be relied upon in course of time to secure the complete eradication of sheep-scab. In pursuance of this aim the compulsory general dipping of all sheep throughout Great Britain, involving a single dipping annually, or, in the case of Scotland and the north of England, two annual dippings at long intervals, was in force continuously from the year 1908 to 1919 inclusive. Sheep-scab was not, however, eradicated. In the meantime, from 1908 to 1912, experimental investigations were carried out at the Ministry's laboratory, which led to the conclusion that a single dipping cannot be relied upon to eradicate the disease from a flock, and that compulsory dipping should mean at least two dippings, separated by a maximum interval of fourteen days between the dippings. This latter principle was adopted by the Ministry in the new policy inaugurated in 1920, when two Orders, entitled the "Sheep-scab Order of 1920" and the "Sheep (Double Dipping) Order of 1920," were issued. The first of these Orders governs the procedure adopted in individual outbreaks of sheep-scab, and the second is applied to areas in which sheep-scab is prevalent, or in which there is reason to believe that the disease may exist unreported. Double dipping, with an interval of not less than fourteen days between the dippings, imposed as a compulsory requirement, is the main principle upon which these two Orders are based. Recently the matter has again been under the consideration of the Ministry, with the result that a new Order entitled the "Sheep-scab Order of 1923" has been issued, directly throwing upon sheepowners the onus of curing and preventing scab in their sheep. A pamphlet has also been issued widely throughout the country by the Ministry advising owners as to the measures which they should adopt. The Minister expresses his hope that the new requirement may achieve some considerable measure of success in bringing about the ultimate eradication of scab.

HONEY-GRADING STORE AT GREYMOUTH.

The increased production of honey on the west coast of the South Island during recent years has necessitated the establishment of a honey-grading store for that district. The store known as Molan's Store, situated in Thompson Street, Greymouth, has been appointed for this purpose in accordance with the regulations relating to the export of honey from New Zealand.

PRESENTATION OF STUD PIGS.

MESSRS. Spicers Limited, London, recently presented to the New Zealand Government a boar and sow each of the Large Black and Large White breeds, the animals being unrelated in each case. These pigs are bred from Royal Show prizewinners. Cabling on 8th October, the High Commissioner stated that it was hoped to ship the animals by the "Port Victor" about the 19th, together with an additional purchased sow of each breed, which had been mated to males unrelated to either of the gift boars.

ELECTRIC POWER IN THE DAIRY INDUSTRY.

IN his annual report for 1922–23 the Chief Electrical Engineer, Public Works Department (Mr. Lawrence Birks), states under the heading of "Industrial Developments":—

"Electric milking plants, which will necessarily form a large proportion of the country load of the Electric-power Boards, have increased by over 100 per cent. during the year. There are now over 1,100 such plants in operation in the Dominion, as compared with 548 last year. The following indicates the distribution of these plants: Thames Valley Power Board, 384; Central Power Board, 247; Te Awamutu Power Board, 152; Cambridge Power Board, 100; Banks Peninsula Power Board, 67; Springs-Ellesmere Power Board, 28; Southland Power Board, 29; Tai Tapu Dairy Company, 36; Hawera Electric Supply Company, 50; other installations, 50: total, 1,143.

"The total number of milking-machines in the Dominion, operated for the greater part by benzine-engines, is 12,468, and is increasing at a rate of over 2,000 per year. There is thus ample scope for the development of electric-power supply in this direction.

"In addition to the milking plants, the dairy factories are proving a useful load, particularly the large butter and dried-milk factories, of which six are now supplied from Horahora."

AUSTRALIAN EMBARGO ON NEW ZEALAND POTATOES.

FURTHER official representations were made recently to the Commonwealth Government with the object of obtaining removal of the prohibition of the importation of potatoes from New Zealand into Australia. Stress was laid on the comparative harmlessness of powdery scab in this Dominion, and willingness to institute a strict inspection of potato shipments at this end was reiterated. A reply has been received from the Commonwealth Government stating that the matter had received careful consideration, but that in view of the information available regarding the incidence and spread of powdery scab in other countries it had been decided that the Government would not be justified in incurring the risk of introducing this potato-disease into Australia.

Weraroa Sale of Pedigree Cattle and Pigs.—The annual stud-stock sale of the Central Development Farm was held on 4th October, with a good attendance of buyers from various parts of the Dominion. In Friesian cattle the herd sire Dominion Woodcrest Piebe Mercedes, which is being superseded by a newly imported animal, was sold at 196 guineas to Dr. S. S. Cameron, of Melbourne. Among the yearling bulls Dominion King Woodcrest went to a Canterbury buyer at 85 guineas, and Dominion Paul Crest was bought for Taranaki at 80 guineas; the average of all Friesian yearlings was 42 guineas. In Red Polls the herd sire Force Majeure went to a Wairarapa buyer for 80 guineas, and the herd sire Aviator was bought for the Waikato at 50 guineas; the two-year-old bull Dominion Sylvan was sold for Southland at 60 guineas; and the yearling sales averaged 34 guineas. Among the Berkshire pigs, weaner boars made from 5 to 16 guineas, weaner sows from 5 to 7 guineas, and sows with litters up to 16 guineas.

INCREASE IN MERINO SHEEP.

For the second year in succession the Annual Sheep Returns (30th April) show an increase in the number of Merino sheep in the Dominion. This year stud Merinos total 29,216, as against 23,612 in 1922; and flock sheep 931,899, compared with 842,293 last year. Included in these totals stud breeding-ewes have increased from 13,550 to 15,886, and other breeding-ewes from 344,663 to 375,287.

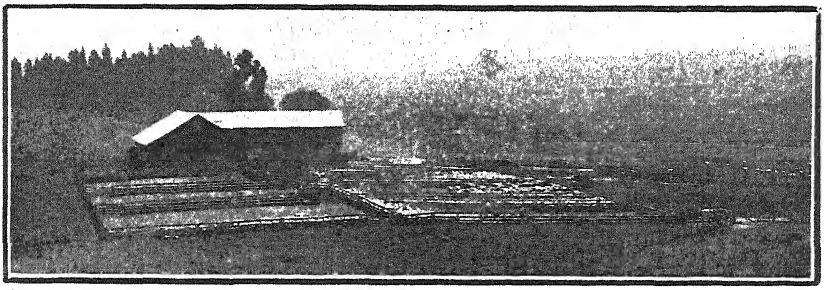
THE STUART WILSON CUP AWARD.

The Stuart Wilson Cup, which is competed for each year by the competitors in the boys' and girls' agricultural clubs conducted in co-operation with the Department of Agriculture, has this year been awarded to L. Stevenson, of Hampden School, Hampden, Otago. This competitor grew last season a crop of Arran Chief potatoes yielding at the rate of 22½ tons per acre. This yield was secured at a cost of £1 per ton. As the average yield of potatoes for the district is not more than 7 tons per acre, his performance is very meritorious, and indicates the value of thorough cultivation in increasing crop-yields. The runner-up for the cup was Harry Betts, of Okaiawa, Taranaki, who grew a crop of mangolds yielding 132 tons per acre, at a cost of 2s. 5d. per ton. A photograph of this crop was reproduced in the August *Journal*. A fair average yield of mangolds in the Taranaki District is somewhere in the vicinity of 50 tons per acre.

FORTHCOMING AGRICULTURAL SHOWS.

Poverty Bay A. and P. Association: Gisborne, 23rd and 24th October.
Marlborough A. and P. Association: Blenheim, 24th and 25th October.
Timaru A. and P. Association: Timaru, 24th and 25th October.
Wairarapa P. and A. Society: Carterton, 24th and 25th October.
Manawatu A. and P. Assn.: Palmerston North, 30th and 31st Oct. and 1st Nov.
Ashburton A. and P. Association: Ashburton, 31st October and 1st November.
Wanganui A. and P. Association: Wanganui, 7th and 8th November.
Canterbury A. and P. Association: Christchurch, 8th and 9th November.
Winton A. and P. Association: Winton, 14th November.
Egmont A. and P. Association: Hawera, 14th and 15th November.
Nelson A. and P. Association: Nelson, 20th November.
Waikato A. and P. Association: Hamilton, 20th and 21st November.
North Otago A. and P. Association: Oamaru, 21st and 22nd November.
Stratford A. and P. Association: Stratford, 21st and 22nd November.
South Otago A. and P. Association: Balclutha, 22nd and 23rd November.
Otago A. and P. Society: Dunedin, 28th and 29th November.
Southland A. and P. Association: Invercargill, 11th and 12th December.
Masterton A. and P. Association: Solway, 19th and 20th December.
Woodville A. and P. Association: Woodville, 22nd and 23rd January.
Feilding I., A., and P. Association: Feilding, 5th and 6th February.
Clevedon A. and P. Association: Clevedon, 9th February.
Dannevirke A. and P. Association: Dannevirke, 13th and 14th February.
Katikati A. and P. Society: Katikati, 21st February.
Rotorua A. and P. Association: Rotorua, 27th February.
Omaha and Pakiri A. and H. Society: Leigh, 1st March.
Taranaki Metropolitan Agricultural Society: New Plymouth, 5th and 6th March.
Waikato Central Agricultural Association: Cambridge, 5th and 6th March.
Morrinsville A., P., and H. Society: Morrinsville, 12th March.
Methven A. and P. Association: Methven, 27th March.
Temuka and Geraldine A. and P. Association: Winchester, 3rd April.

(Agricultural and Pastoral Association secretaries are invited to supply dates and location of their shows.)



The New Zealand

Journal of Agriculture.

VOL. XXVII.—NO. 5.

WELLINGTON, 20TH NOVEMBER, 1923.

THE GRASSLANDS OF NEW ZEALAND.

SERIES II. THE TARANAKI BACK-COUNTRY.

E. BRUCE LEVY, Biological Laboratory, Wellington.

2. GROWTH-FORM AND HABITS OF SECONDARY GROWTH IN RELATION TO CONTROL.

IN the control of secondary growth, or, in fact, of any weed, it is useful for the farmer to know the habits and growth-form of that weed and its behaviour under, or its response to, differential farm-practice. By a study of the life-history of the plant we often can pick out weaknesses manifest at some stage in its yearly cycle of growth which can be turned to our advantage in the control of that weed, in much the same way as in the control of insect and fungoid pests. Indeed, it may be put down as an axiom in weed-control that any weed should be attacked at that point or period of the year where and when it is most vulnerable. This article will deal more or less with the growth-form and methods of propagation and spread of the most troublesome scrub plants of the Taranaki back-country, and will endeavour to indicate the vital weak spots in each class of growth.

The secondary-scrub growths causing most of the trouble in the Taranaki back-country are hard fern, manuka, bracken-fern, water-fern, and piripiri. Of these hard fern and manuka are the most difficult to deal with.

HARD FERN.*

This fern (Fig. 20) forms a carpet-like mass 12 in. to 18 in. tall, fairly dense to the bottom, which is often filled up with dry dead fronds of previous years' growth. It spreads from out of the shelter of logs or stumps, or from points of establishment on dry open knolls. Its spread is by means of branching, wiry, dark-coloured rhizomes, which creep over the surface of the soil. In this surface-growing rhizome lies the greatest weakness of the plant. Stock injure it readily by their treading, and it is particularly liable to destruction by fire in a season when the foliage is sufficiently dry to carry a hot fire (Fig. 21). The time of burning hard fern is important. A hot fire is essential,

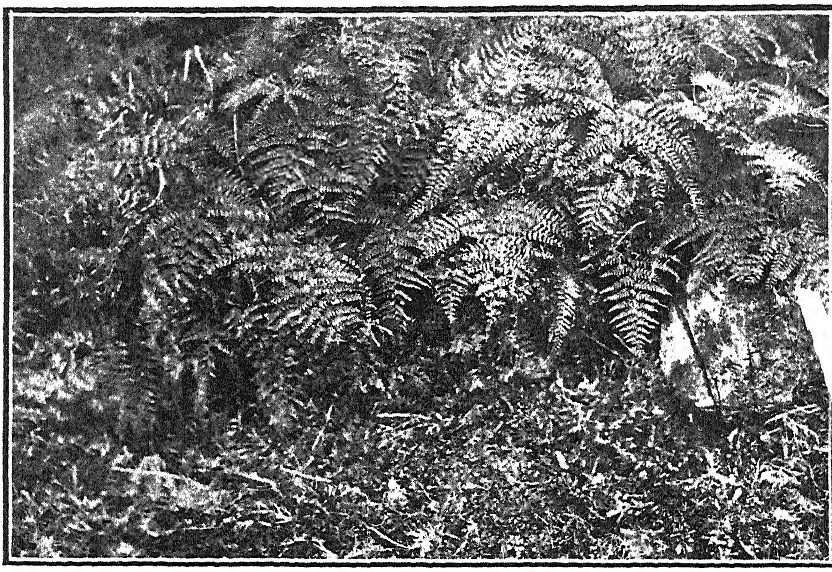


FIG 20. EDGE OF A HARD-FERN PATCH.

The grass sward is here very closely grazed down, a condition favourable for the outward spread of the fern.

[*Photo by E. Bruce Levy.*

and burning should not be carried out until the soil-surface is well dried out. Early spring burning is often practised owing to the fact that during a severe winter the previous year's fronds are all dried up, being killed by frost. These carry a surface fire, but the soil-surface is usually wet in the spring, so that the surface rhizomes remain undamaged and new fronds come away soon after the fire (Fig. 22).

Every endeavour should be made to get grass established on the hard-fern burns, so that stock may be enticed there and thus damage any small pieces of fern that may have been missed by the fire. The spring-time does not afford opportunities for the establishment of grass

* For botanical description and illustrations of hard fern, common bracken-fern, and water-fern see "The Bracken-ferns of New Zealand," by Esmond Atkinson, this *Journal*, January, 1923.

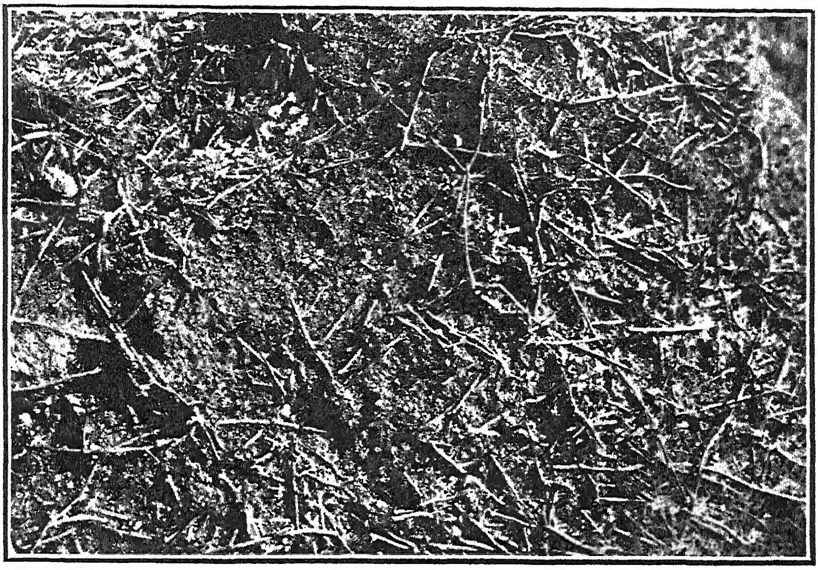


FIG. 21. HARD FERN DESTROYED BY FIRE.

The thin wiry rhizomes may be seen right on the surface. In the central portion of the photo the rhizomes have been largely burnt out by the fire.

FIG. 22. NEW GROWTH OF HARD FERN AFTER A LIGHT FIRE.

It is better to lose a season than to burn while the surface of the soil is not thoroughly dry. Note the weeds that have come in on the failure to secure a take of grass.

[*Photos by E. Bruce Levy.*

on secondary-scrub burns, and this is particularly true in the case of hard fern, for the great mass of surface rhizomes and thread-like roots form a hard compact surface most readily dried out in the hot weather of summer. Autumn burning in a dry season seems to afford the only hope of combating this weed; and while it is recognized in the Whangamomona district that one cannot always rely on getting a dry season, yet it would seem wiser to miss a season or two than to attempt the burn at a time when the soil-surface is not dry. The autumn affords the greatest chance or success, not only in the burning but also in the establishment of grass on the burn.

The growing-point of the surface rhizomes of hard fern "feels" somewhat for the light, and it will not penetrate a densely shaded cover. As the rhizome grows forward in contact with the soil it sends down thin thread-like roots, and at the same time somewhat slender fronds into the air. Therefore, as in the case of a great many other weeds, in order to spread satisfactorily, the surface rhizome must contact the soil, else the new roots cannot develop. By constant grazing of the turf around the clumps of hard fern the grass is kept short, and hence light is allowed to penetrate freely to the young outspreading rhizome, which consequently keeps close to the ground and spreads, rooting as it goes (Fig. 20). There is also nothing above to hinder the upward growth of the young frond. If a fairly dense shade and competition with other plants is provided (as by a good growth of grass induced by spelling the pasture), then the rhizome tends to rise slightly off the ground so as to avoid penetrating the denser growth. When the rhizome thus loses contact with the soil-surface no roots are formed and its growth is inhibited, and what growth is formed is very liable to be destroyed by stock when these are once more turned on to the area.

From the foregoing, then, it would appear that control of hard fern centred about three practices: (1) Burning of the hard fern in autumn in a season sufficiently dry for a hot fire to be secured; (2) the sowing of these burns with suitable grass-seed; and (3) the spelling of the pasture to induce a good grass-growth about the hard-fern clumps. The spelling also enables a heavy stocking at any one period of the year when the fern is most injured by treading.

BRACKEN-FERN.

Bracken-fern has an element of very great weakness in that its frond is eaten by stock. The rhizome of bracken-fern is well below the soil-surface, usually 6 in. to 8 in. deep, but at times 1 ft. or even more on certain light sandy or pumice country. The rhizome is thick, and in it is stored an immense amount of reserve plant-food. In the early spring from this underground rhizome new fronds are formed, and these draw during the early period of their growth — that is, until they uncurl — on the food-reserve in the underground rhizome. The new fronds appear above ground as tender, brittle, curled structures, most susceptible to injury by grazing animals (Fig. 23). This curl stage is, without doubt, the weak point in the annual growth of the bracken-fern. Every frond broken off in the curl stage means a reduction in the vitality of the plant, and just as long as the process can be repeated each time new fronds appear the draw upon the

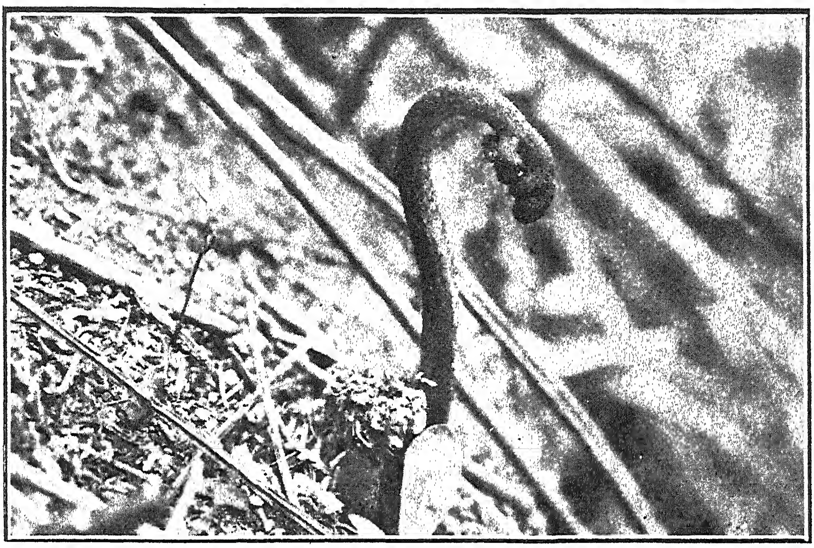


FIG. 23. BRACKEN-FERN IN THE CURL STAGE.

During this stage, and until the fern uncurls, the frond is extremely brittle, and may be rapidly broken off or eaten by stock.

FIG. 24. BRACKEN-FERN ONE YEAR AFTER THE BURN WHERE NO SEED HAS BEEN SOWN AND NO STOCK ALLOWED ON TO THE AREA.

The fern-fronds are at this stage manufacturing food to be stored in the underground rhizome for next year's growth.

[*Photos by E. Bruce Levy.*

reserve food in the rhizome becomes so great that ultimately the supply becomes depleted and no more fronds appear above ground. If the frond is allowed to get out of the curl stage it becomes tough and stringy and less palatable to stock. Again, just as soon as it uncurls it begins manufacturing plant-food, which goes to maintain the food-supply, and hence the vitality of the underground rhizome (Fig. 24).

In order to deal satisfactorily with the bracken-fern in the curl stage some food other than the fern must be provided, else the stock rapidly go back in condition. The fairly long dormant period of bracken-fern during winter usually makes it possible to get grass well established on the fern-burn before the young fronds begin to appear, which is usually in October or late September. Bracken-fern control therefore appears to resolve itself into an attack on the plant along two lines: (1) Crushing by stock in the early spring and summer, while the fern is in the curl stage, and (2) the production of pasture plants on the bracken-fern area during its dormant period—March to October—in order that this stocking may be satisfactorily carried out.

WATER-FERN.

Water-fern requires a good deal of moisture and shade in order to thrive. It is troublesome mostly around stumps and logs, or on higher-altitude farms where the rainfall is heavy. It does best in somewhat loose soil containing plenty of humus in the form of leaf-mould or rotten logs. The rhizome is well below ground, being on the average 2 in. to 3 in. deep. It is stout, but not so well supplied with reserve food as is bracken-fern. The young fronds are fairly numerous, large and fleshy, and grow for the most part in winter and spring. Frost, however, injures the growth in the winter. If stock can get in among water-fern they can be very damaging with their feet, owing to the big, fleshy, curled fronds being readily broken off. Moreover, from the fact that the rhizome does not contain the same reserve food as in bracken-fern, the plant is much more readily crushed out than is bracken. Stock also eat the herbage to a small extent even when the frond is expanded. On water-fern areas it is difficult to get a burn, so that pasture plants are introduced with greater difficulty. Water-fern scarcely ever comes out into the open, and usually as soon as the logs are removed and when the land has become more consolidated by stock water-fern ceases to trouble. On certain farms in the country under consideration, however, water-fern is still spreading considerably, forming large clumps.

MANUKA.

Manuka, once it becomes well established, cannot be controlled by stock alone and the slash-hook must be employed to fell this scrub-growth. This is a costly business, but there is apparently no alternative. To burn standing manuka that is bearing seed is worse than useless. Manuka once cut will not grow out afresh from the cut stumps (though any small branches left low down on the stump will grow), and were it not for the fact that this plant seeds so profusely its control would be comparatively easy. The seed habit may be termed almost a mania with manuka: one plant in a single season

will produce millions of seeds, all of which apparently are fertile and capable and eager to produce a young plant. This apparent readiness of germination is, as far as the writer can see, the weak point in manuka, provided the problem is attacked in the right way. Either the plant must be cut and burnt before the seed is shed, or else cut and left on the ground until such time as the seeds have germinated and have established as young plants among the cut dead manuka (Fig. 25). The seeds germinate readily in spring (end of September). and provided opportunity offers it would appear that all seeds germinate the same year that they mature and fall (this point needs more definite investigation, however), so that if a fire can be run over the whole cut surface every manuka seedling will be killed outright. Provided there

FIG. 25. GERMINATION IN MASS OF MANUKA-SEEDS IN EARLY SPRING.

The young seedlings may be noted in the cotyledon stage coming up among the strewn manuka-branches. About natural size.

[*Photo by E. Bruce Levy.*

has been a good fire one may search in vain on an old manuka burn for young manuka seedlings.

The time of cutting and burning, therefore, is very important in manuka-control. In the ordinary course of events the manuka-seed crop is ripe about the end of July, and most of the capsules have opened and have shed their seed on to the ground by the end of August. There are, however, a small proportion of capsules that do not open with the main crop. These may remain closed for a whole year or even longer, so that no matter what time of the year the manuka is cut there is always some seed on the plant. These latter capsules, so soon as the plant is killed by cutting or by fire while standing, mature, and, opening up, shed their seed on to the ground. If the

manuka is cut before spring they will have opened along with the main crop, and they will germinate along with the rest. If the manuka is left until summer before it is cut there will always be a certain number of seeds shed on to the ground that have not germinated at the time of firing, and it must be remembered that a dormant seed is much more difficult to kill by fire than is a young tender seedling. Any seeds that are not killed will, of course, readily germinate and become established soon after the fire.

Late spring burns will kill virtually all the young seedlings, but this time of the year does not offer opportunity for getting grass-seed established on the burned surface. The fact must always be borne in mind that manuka (and, for that, most weed-seeds) will not germinate and establish within a close grass sward. It is only when the grass sward opens up that such become established. Autumn burning of cut manuka not only destroys manuka seedlings, but also affords opportunity for the sowing of grass-seed with a good chance of its successful establishment. Manuka which has been cut and which has lain for long loses the greater portion of its leaves, and thus it may not carry a fire so well as when fired soon after being cut. As the winter is the most opportune time for the farmer to get out to cut his manuka, spring burning is often practised. Where there is already a certain amount of grass such as danthonia, New Zealand rice-grass, &c., among the manuka, spring burning is probably more beneficial to the grass than autumn burning would be, provided the burn is done before the new season's growth has commenced. On areas, however, where sowings of grass-seed are being made the burn should be in the autumn.

Standing manuka that is old enough to bear seed should never be fired. This is the opinion of the best farmers of the Wairarapa and Hawke's Bay districts, where they have had considerable experience with manuka. The heat of the fire is seldom sufficient to consume the seed-capsules on the living plant, and the heat really acts as a ripening process to the capsule. The latter consequently opens soon after the fire has been through, and the seed is shed on to the ash left by the fire. Here there is no competition, and the conditions are ideal for the establishment of the seedling (Fig. 26). Numerous instances have come under the writer's notice where thousands of young manuka-plants to the square foot have come up on standing manuka burns (Fig. 27).

In the Whangamomona district also patches of hard fern are usually associated with the manuka until the latter becomes dense. If such areas are burnt standing the fire sweeps over the top of the hard fern, leaving its rhizomes comparatively undamaged (Fig. 28). Felling the manuka on these areas means that a much more intensely hot fire is secured close to the ground surface, and thus the hard fern may be entirely killed out by the firing. The manuka-plant itself is readily killed by fire, and this fact can be made use of in the burning of manuka areas while the plants are still small—but only provided no seed-capsules have matured. To do this there must be some growth such as danthonia, brown-top, or paspalum present that will carry a fire.

FIG. 26. MANUKA SEEDLINGS, ONE YEAR OLD, ESTABLISHED AFTER A STANDING-MANUKA BURN.

The unopened capsules on the tree are ripened by the fire, and they then shed their seed on to the ashes of the burn.

FIG. 27. STANDING-MANUKA BURN ON A PEAT-SWAMP.

Thousands of young manuka-plants were here established on every square foot of soil-surface.

[*Photos by E. Bruce Levy.*

The burning of standing manuka on country where the bracken-fern has not been killed out before the incoming of the manuka almost invariably leads to an immediate pure bracken-fern association. On all that country where bracken-fern forms a phase in the forest succession this return of bracken is likely to happen so soon as the growth that replaced the bracken in the succession is destroyed by fire (Fig. 29). It would appear that the rhizome of bracken-fern is capable of remaining in a dormant state in the soil for many years, and once the shade of the top growth is removed the bracken once more springs into being. On the second-class soils where bracken is not thriving luxuriantly manuka will often come into the standing fern, and in the course of eight or more years will so overtop the bracken that its growth is subdued, and the association to all intents and purposes becomes a pure manuka association. Now, should this manuka be burnt standing, the growth that follows immediately is not manuka but bracken-fern, which holds sway until such time as the manuka seedlings, established after the fire, again grow through the fern and once more begin to overtop it.

This alternation of manuka and bracken-fern associations is not very common in the Whangamomona County, for usually the bracken-fern is killed out before the incoming of the manuka, and here, in a state of nature, manuka does not form a phase in the succession, the soil being sufficiently good to carry either a wineberry-lacebark-fuchsia successional association, or else one of tutu-veronica-fivefinger-karamu-kohuhu, &c. Manuka there comes only after the soil has become considerably depleted.

Manuka-control, it will be seen, is largely an attack on the plant in the seedling stage; and the regulation of practice, both in the felling and in the burning, should be towards effecting the most damage at this stage. Spelling the pasture while the manuka is young, so as to get sufficient grass-growth to carry a fire, attacks the plant in another vitally weak spot.

PIRIPIRI.

This weed demands for its spread and prosperity a turf closely grazed by an animal that will not eat its foliage. Sheep-grazing alone fulfills these conditions almost perfectly. The plant in its habit of growth comes into the group of pasture-weeds that spread by means of an overground runner which clings close to the ground, rooting as it goes. Hard fern, it will be noted, also belongs to this group. The surface runner of piripiri is drawn up to the light by shade-forming plants much more markedly than is hard fern, and in this character lies the greatest weakness of piripiri as a plant. Cattle beasts also will eat it. The conditions of the dry knolls, which are usually the point of establishment of piripiri in a new burn, favour the spread of this plant because the grass-growth there is usually too poor to completely cover the ground. Consequently the runner of piripiri is able to keep contact with the ground, and thus the plant spreads to the edge of the knoll. The better grass-growth surrounding the knoll usually inhibits further spread until such time as this grass becomes closely grazed down.

FIG. 28. GROWTH OF HARD FERN AND MANUKA AFTER A STANDING-MANUKA BURN.

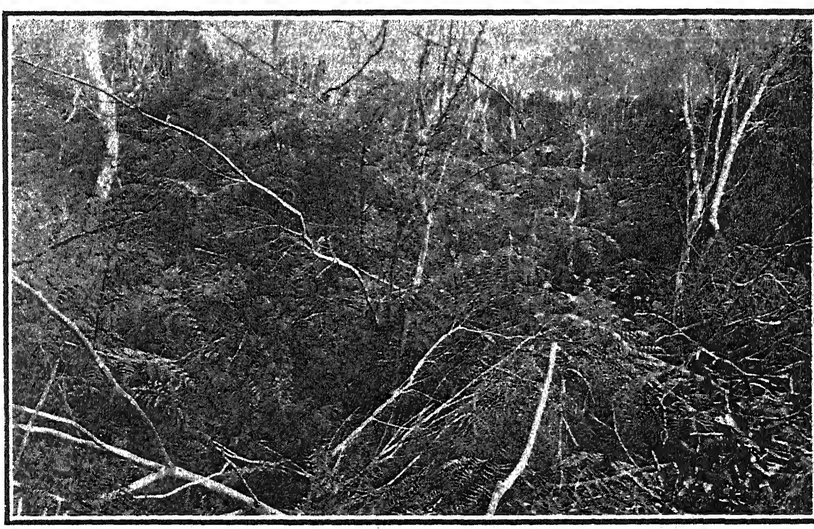


FIG. 29. BRACKEN-FERN ASSOCIATION APPEARING IMMEDIATELY AFTER A YOUNG SECONDARY-FOREST BURN AT TAHORA.

[*Photos by E. Bruce Levy.*

FIG. 30. PIRIPIRI IN A CLOSELY GRAZED PASTURE.

Showing how sheep keep the grass-turf close immediately bordering the piripiri patches. This favours the spread of piripiri.

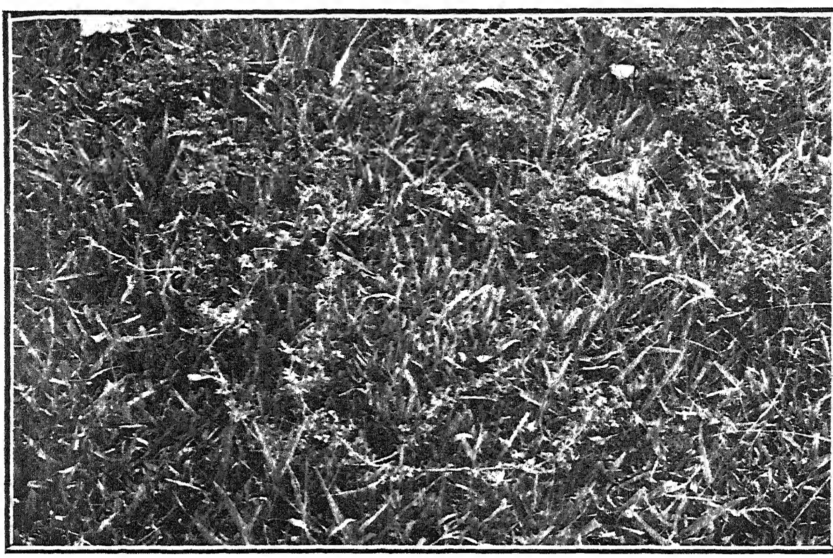


FIG. 31. PIRIPIRI BEING KEPT UP OFF THE GROUND BY A GOOD SWARD OF GRASS.

Note the two long runners in the centre of the photo, some 3 ft. long without a single root. The grass-turf is one of paspalum.

[*Photos by E. Bruce Levy.*

Piripiri itself is almost entirely neglected by sheep, and they will not browse among it unless forced to do so by lack of feed elsewhere. The sheep, however, graze close up to the edge of these piripiri patches, keeping the grass here extremely short (Fig. 30). Thus light is allowed into the overground runners, and the outward spread of the plant is assured. If these edges of the piripiri clumps are shaded (such as by spelling the pasture as in the case of hard fern) the runners may readily be made to leave the ground, the new growth turning upwards in order to reach the light. When this happens the runners no longer send out roots into the soil, but travel along the surface of the grass as loose trailing stems most susceptible to injury by the grazing and treading of stock (Fig. 31). Cattle eat the piripiri to some extent, and they have not the aversion to going among it that sheep seem to have.

The facts that cattle will eat the plant and that the growth-form may be altered considerably to its disadvantage by stimulating shade-forming plants among and around it suggest the following methods of procedure in its control: (1) Spelling the pasture to shade the overground runners of the plant so that these lose contact with the soil, being drawn up to the light; and (2) the grazing of these spelled areas by cattle.

GENERAL.

From the foregoing it will be seen that the habits and growth-form of a plant are big factors in deciding what methods should be employed to successfully control that growth. The importance of the grass sward and of the stock capable of being maintained by means of that sward are manifest throughout. These really are the two great weapons available to farmers for the control of most weed-growth, and any method for the control of weeds that does not take these two important factors into consideration must, in the writer's opinion, be economically unsound. It is realized that the farmer in the Taranaki back-country is up against the great difficulty of securing this grass sward and in getting it to hold, and this is one of the first phases of study and experiment we are undertaking in our woık in Whangamomona County.

(To be continued.)

Brown-top Seed.—Special investigation work into the possibilities of extension of our export seed trade to America in brown-top (*Agrostis tenuis*) seed was carried out at the Department's Biological Laboratory during the past year, and possibilities of extension in this direction have opened up. Collections of the various *Agrostis* species have been made throughout each district in New Zealand, and these have been studied and the dominant forms determined as to species. The dominant form of *Agrostis* in New Zealand has now been determined by Dr. C. V. Piper, Agrostologist, United States Department of Agriculture, as being brown-top (*Agrostis tenuis*), for the seed of which he reports there is, in his opinion, an extensive market in America. The outcome of this research will have quite an important bearing on the economy of grassland farming on our first-class short-rotational grass-land soils.

LAMB-BREEDING FOR THE MEAT TRADE.

WHITE-FACED BREEDS AND CROSSES.

J. G. COOK, Live-stock Division.

In the *Journal* for January last (page 50) were published some notes by the writer on the Down breeds and crosses for the fat-lamb trade. Other sheep breeds and crosses represented in New Zealand are dealt with in the present article.

It will be well to emphasize, in the first place, the importance of selecting breeds or their crosses suitable to the climatic and land conditions of the locality or farm. A great deal depends on whether the land is heavy or light, swampy, arable, or tussock, or bush-burn country, and so on. Raising sheep or lambs under conditions which are in their favour will, as a rule, yield satisfactory returns, whereas the reverse will be the result if it is attempted under conditions which do not allow the sheep a fair chance of doing the best they are capable of. The consumer is not concerned about the breed of the lamb or mutton he buys, but looks for meat of good quality and colour, with a large proportion of lean.

In New Zealand we have several of the white-faced, longwool breeds—namely, Romney Marsh, Lincoln, English Leicester, Border Leicester, and Wensleydale. Cotswolds and Cheviots were kept some years ago, but it was found that conditions did not suit them, and their breeding was consequently abandoned. Rams from each of the breeds named were mated with Merino ewes in several provincial districts, with the object of ascertaining which cross would produce lambs with a carcase most suitable for the frozen-meat trade.

LINCOLN CROSSES.

The Lincoln ram mated with the Merino ewe produced good results, the progeny being called half-breds. The lamb is of good frame but compact, and, although it takes more time to fatten when compared with some other lines, this cross is greatly in favour in one or two important sheep districts. If not sold as a fat lamb the animal usually develops into a fine hogget, and cuts a good fleece of shafty combing-wool. If topped off after shearing it will make a good freezing carcase, and always sells well. The ewes of this cross are always of value, as, having normally a very sound constitution, they grow into a really good line.

This class of ewe can be mated with a half-bred ram if it is desired to keep to the half-bred line, but, if desired, ewes can be mated back to the Lincoln ram. The progeny from the latter crossing is termed three-quarter-bred — that is, three-fourths longwool and one-quarter Merino. This is a good line, but, coming back to the longwool, the meat is somewhat coarser in the grain than that of the first cross. Experience, too, shows that the three-quarter-bred takes longer to fatten than the half-bred.

The three-quarter-bred ewe can be mated with a Southdown ram, the progeny making an excellent freezing line. With the first cross (half-bred) and the second cross (three-quarter-bred), the lines throw to the Lincoln ram in the length of the wool. Further, they keep the wool on well, as the tip is harder and stands a good deal more knocking about than with some other crosses.

ENGLISH LEICESTER.

The crossing of English Leicester rams with Merino ewes gives a very fine line of lambs, also termed half-bred. This lamb catches the eye on account of its well-shaped head (which also makes the lambing easier), well-sprung ribs, nice broad back, and full rump and short legs, with meaty hind quarters. It was on this cross that Canterbury Province mainly built up its world reputation for "prime Canterbury" in both lamb and mutton, and it will always hold good.

If not required for slaughtering as lambs, but intended for sale after being shorn as hoggets, the animals should be kept in a progressing condition up to the time required, when with but a little topping-off they are ready for the market. When intended to be kept on the place until four- or six-tooth they can be grazed on the higher country, and, according to the feed available, kept there until about eight or ten weeks before selling, when they should be brought in, put on to good feed, and finished. This line will always cut a good fleece of shafty combing-wool which is sought after by buyers. The ewes are valuable, and if it is desired to keep to the same line they can be mated with half-bred rams. If mated with the English Leicester ram the progeny will be three-quarter-breds. Wether lambs should be sold off as soon as they are fat enough for the market.

If the ewes of the line are kept and classed out the coarser-woolled animals should be mated with Southdown rams and the finer-woolled with the Shropshire. In either case the line produced will be a good freezing one, and the quality of the wool more even than would be the case if the ewes had not been classed out and mated with one breed of Down ram only. Any lambs produced by using Down rams are best sold off the place as soon as ready for market, because their strong point is meat and not wool-production. None of the Down cross should be allowed to get in among the breeding-ewes, as by keeping the breeding-flock separate the class of rams required are easier worked than if there was a mixture of all breeds throughout the ewe flock.

BORDER LEICESTER.

The progeny of the Border Leicester rams and the Merino ewe—again termed half-bred—is rather a smart-looking lamb with ears nearly always pricked, showing that the animal is on the alert. These lambs are good travellers, and meet with a ready sale. They fatten fairly quickly, throwing to the Border Leicester in that respect. They have to be got away fairly early, as later on they are inclined to run to leg, which, when killed, shows a bit long in the shank-bone, making the carcase look longer. The meat, however, is of a good, clean-looking colour. There is also commonly a fault as regards the wool, which is somewhat on the light side. This becomes more apparent

as the sheep ages, and is termed "going off in the wool." If the ewes of the half-bred line are kept on the place, and it is desired to keep to and breed the same line, they should be mated with the half-bred ram. If the ewes are mated with the Border Leicester ram the progeny will be three-quarter-breds. The whole line may be sold off as fat lambs, but if any ewes are retained they can be mated with either Southdown or Shropshire rams. After the subsequent lambing, when ewes and lambs are ready for market they should be sold off.

The Border Leicester ram is used a good deal in Canterbury and north Otago for producing half-bred lambs. In the rest of Otago and in Southland the ram is used a great deal to mate with Romney ewes. The lambs from this crossing are good doers, and they usually kill out at high weights.

CHEVIOT, WENSLEYDALE, AND COTSWOLD.

In the past Cheviot rams were sometimes mated with Merino ewes, and for a while this cross progressed in one or two of the southern districts, but as time went on, and the Border Leicester, Romney, English Leicester, and Lincoln breeds and their crosses were found to be more suitable, the Cheviot was dropped.

Some years ago the Wensleydale was mated with small numbers of Merino ewes, but this cross was not kept going like the other lines mentioned. The half-bred lamb produced was somewhat similar to the English Leicester ram and Merino ewe cross, but the few farmers who had the line did not keep to it. They might have done so had the importation of the rams been more frequent or numerous.

Mating of the Cotswold ram with Merino ewes produced rather a good lamb, but there was a good deal of trouble in lambing, and the cross is now practically out of existence as far as New Zealand is concerned. In the "sixties" and "seventies" there were a fair number of them in this country.

ROMNEY.

The Romney Marsh ram mated with the Merino ewe gives a good strong lamb. The progeny (half-bred) mature fairly quickly, but they have not been bred to the same extent as the Lincoln-Merino, English Leicester-Merino, or Border Leicester-Merino crossings. It was with the Romney ram and Merino ewe progeny that the late Mr. James Little first tried inbreeding. The Romney is mostly used for crossing with other longwools, more especially in the North Island and the Westland and Southland Districts, where it gives very satisfactory results. The Romney is the predominating breed in New Zealand.

RYELAND.

The Ryeland breed is also suitable for the fat-lamb or mutton trade, the body being square, compact, with a good loin and well-filled leg. The line matures quickly, thus coming to hand early, and there is a good percentage of lambs sold direct off the ewes. Needless to say, when this can be done with any breed or cross it lowers the cost of production to the grower. Then, there is the first-cross produced by mating Ryeland rams with ewes of other breeds. The progeny

of the cross with any of the Down ewes make an excellent line and mature quickly. Mated with half-bred or Corriedale ewes the line produced is a good one, but takes slightly longer to fatten than the Down cross. The progeny of the cross with Romney, Border Leicester, English Leicester, or crossbred ewes is usually very suitable for the meat trade.

DORSET HORN.

The Dorset Horn is another breed suitable for either fat lamb or mutton. Only a few have been imported into New Zealand at different times, and thus there has not been enough of the breed about to make it conspicuous. It has been noticed, however, that when the rams were mated with other lines of ewes the progeny came to hand early and gave a suitable carcase.

CORRIEDALE.

Finally, reference must be made to a breed of purely New Zealand origin, the Corriedale. Owing to the strain of Merino in it, this breed takes a little longer to fatten than some others, but when ready it makes a very good carcase. The meat is nicely fine in the grain and pleasant to the palate. If unable to fatten the lambs in time they can with safety be held over. The hogget gives a fleece of splendid wool, after which it can be fattened and sold. If the ewes are held for breeding purposes they may be counted on for a lamb and a good fleece every year as long as their teeth last.

INCIDENCE OF THE FAT-LAMB INDUSTRY.

In order to give an indication of the extent and distribution of fat-lamb raising in New Zealand the gradings of the lambs slaughtered during the $5\frac{1}{3}$ years' period of the Imperial meat requisition (1915–20) are here set out as follows:—

Specially prime and Canterbury quality: North Island, 543,546 carcases; South Island, 5,804,527; Dominion total, 6,348,073.

First quality, 42 lb. and under: North Island, 4,411,941; South Island, 1,734,913; Dominion, 6,146,854.

First quality, over 42 lb.: North Island, 257,459; South Island, 1,125,842; Dominion, 1,383,301.

Second quality: North Island, 987,882; South Island, 1,938,142; Dominion, 2,926,024.

Of the above aggregate total for the Dominion of 16,804,252 carcases the number killed at the freezing-works in the Canterbury Province was 7,158,149, graded as follows: Specially prime and Canterbury quality, 5,029,994; first quality, 42 lb. and under, 279,029; first quality, over 42 lb., 677,399; second quality, 1,171,727. This leaves 9,646,103 which were killed at the remainder of the meat-export works in the Dominion.

NOTES ON SOME LITTORAL AND OTHER SOILS.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

FROM time to time for various reasons soils have been analysed fully in the Department's Chemical Laboratory, although this is not the practice unless the work is required in connection with some special investigation upon which departmental officers are engaged, or unless on request from some member of the public who is willing to pay the fee for such work, which is £5 5s. per sample. As a number of soil surveys are at present in progress in various parts of the Dominion, under the control of different chemists, publication of the results of analyses of miscellaneous samples made by this Department during the last three years may be useful to those engaged in the study of the science of the soil, and are here recorded mainly with that object.

LITTORAL AND SALTY SOILS.

O 809 and 810 (see tables) are two samples, collected under the direction of the district Fields officer, from the Little Shoal Bay Reserve, at Northcote, a tidal reclamation of 30 acres on the Auckland Harbour north shore, which it was desired to convert into a playing-field. O 809, taken among rushes, was a dark soil containing much organic matter. O 810, taken from the middle area, was a composite sample of a light-coloured soil with little organic matter. Analysis shows that the soils, which are sandy loams, are well supplied with total potash, and available potash is present in excessive amount. The percentage of available and total phosphate is low. The amount of salt present is not on that ground sufficient to deter an attempt to grass the area after it has been protected from further sea submergence. The amount of salt present is under a half of 1 per cent. (0·5 per cent.). Most farm crops, according to Sir A. D. Hall, will grow on a soil which contains one-quarter of 1 per cent. (0·25), and in Egypt grasses grew freely when there was as much as 1 per cent. of salt in the soil. Success with treatment of salty soils in New Zealand is mentioned on page 104 of this Department's annual report for 1907.

A more serious proportion of salt is contained in M 636, a fine sandy loam, collected under the direction of the district Fields officer from Park Island, an island of 100 acres at Napier, containing land subject to flooding by sea-water at high tides. The amount of the salt in this soil was 2·8 per cent. All plant-foods are present in very high proportion, especially the available phosphoric acid. It will be interesting to learn at what rate the salt will decrease in the soil when the stop-banks which it is proposed to construct have fully shut out the flowing tides. If this is successful no doubt it will be possible to grow such crops as mangolds and asparagus, and eventually, when the salt has diminished, the whole will become a fertile garden.

O 816 and 817 are two coarse sandy soils, forwarded at the instance of the district Fields officer, from a littoral area at Wharenui, Cape Campbell, Marlborough, between the Wharenui Railway-station and the sea, and about 4 chains from it. These soils are well provided with all mineral plant-foods, but suffer from the extremely coarse texture common to sandy soils. The high content of available phosphoric acid will be again noticed—a frequent character in sea-littoral soils. Improvement methods should be based on an attempt to improve the coarse texture by applications of organic manure or by green-manuring, or by applying soils of finer texture, such as those containing finer particles.

M 651 and 652 are samples from the Te Arai Settlement, Gisborne, Section 5, Block IX. These are soils of very fine texture. M 651 would probably be very hard to cultivate, from the large percentage of fine silt and clay and low percentage of coarse and fine sand. M 652 has a much better texture. The amount of salt present is small, and affords no reason for suspecting that the land would prove infertile from this cause, although further inundation from salt or brackish water might increase the amount of salt present. Owing to the absence of any lime requirement and the high amount of all plant-foods present, this land should grow excellent pasture. The high amount of available potash and phosphoric acid present should be noted.

ORCHARD SOILS.

P 1245 and 1246 are soils from the Huapai Orchard Settlement, North Auckland. P 1245 was a sample of the stiffer soil of the district, considered especially suitable for apples. P 1246 is a much more friable soil found in patches and considered more suitable for citrus fruits. (The occurrence of patches of good soil is most noticeable in all poor gum-land soils. May not each patch mark the previous site of some gigantic kauri-tree, which is known to shed bark and leaves and so build up a mound of decaying organic matter within the circumference of its spread of branches ?) The analyses of these soils disclose the fact that available and total phosphoric acid is present only in traces, while the other essential plant-foods, especially nitrogen, are present in fair proportion. The application of phosphatic manure must therefore be an essential feature in any fruit-farming operations.

P 399–402 are some orchard sandy-loam soils from the Te Mata Road, Havelock North, Hawke's Bay. The outstanding feature of these soils is the deficiency of available and total phosphoric acid. Application of phosphates must form an important part of any scheme of improvement.

SOILS OF FINE TEXTURE.

L 974, a fine sandy loam from Tokirima (Wanganui River basin), is an interesting soil, as it is from a country originally growing fern, and therefore easily brought in to pasture, but which, notwithstanding, grows very good pasture. There are many thousand acres of this type, and it probably owes its low primitive type of vegetation to the fact that the soil is derived from recent volcanic-mud showers.

As one would expect from its high total nitrogen content and low phosphate content, the soil produces excellent yields of all leafy crops, but fruiting-crop yields are not so good. The application of phosphatic manures will tend to balance the inequality which at present exists.

L 973 is a fine sandy silt from the flats on the Ohura River, a tributary of the Wanganui River. This is a very fertile soil, derived from an esteemed kind of papa rock (mudstone), and it contains good amounts of plant-food.

P 272 and 273 are fine sandy silts from Ruatorea, a little-known district near the eastern limit of the North Island. The deficiency of this soil is one related to texture, which is manifested by a drying-up in summer. Green-manuring will probably be the means by which these soils may be ameliorated, as applications of clay are not feasible.

M 362, a silty loam from Claudelands, Hamilton, is a poor soil with a high lime requirement and a low phosphate content.

O 759 is a fine sandy silt from low terrace land by the Rangitikei River, at Bull's. It was complained that young sheep do not do satisfactorily on pasture grown on this terrace. Plant-foods and lime are present in good proportion except phosphoric acid, which is decidedly deficient, and the writer considers that this is sufficient to account for the ill success experienced with the stock. Good dressings of phosphatic manures were therefore recommended.

O 714, 715, and 716 are a series of soils—fine sandy loams—from an area near Palmerston North. O 714 was a virgin soil taken in light bush, and bears a marked similarity to the sample K 387 taken in the Palmerston North Esplanade Gardens, in similar small forest (see *Journal*, Vol. 21, 1920, p. 112). The other samples, O 715–6, were taken in grassed paddocks upon which a curious malnutrition disease had developed in horses. The grassed paddocks adjoined the area containing bush, and therefore the soils were probably at one time of the same composition.

SOILS OF COARSE TEXTURE.

R 58 and 60 are sandy silts from the Parihaka Soldiers' Settlement, collected for me by the District Inspector of Stock. R 58 was a top soil taken from flat ground of an old Maori clearing. R 60 was from the top of a mound about 40 ft. or 50 ft. above the level of the flat ground. These are sandy silts, apparently deficient in available phosphate. The high amount of lime soluble in hydrochloric acid suggests that superphosphate would effect a considerable increase in the productiveness of this settlement.

P 341, from Waiomoko, Gisborne, is a pumiceous sandy soil of a dark colour, due to the organic matter present. It is well supplied with plant-food, especially that present in an available form. The lime requirement is high, and liming is therefore recommended, especially for rape and turnip crops, which are found to fail after initial crops have been taken.

Mr. L. D. Foster, Analyst, efficiently carried out the chemical and Mr. R. E. Grimmett, B.Sc., Analyst, the mechanical work described in this article.

LITTORAL AND OTHER SOILS.—CHEMICAL ANALYSES.

(Results, except *, are percentages on soil dried at 100° C.)

Laboratory No.	Locality.	Volatile Matter.			Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method, Hall's Modification ("Available" Plant-food).				Hydrochloric-acid Extract ("Total" Plant-food).				Lime Requirement (Percentage $CaCO_3$).		Sodium Chloride.
		* On Air-drying.	*At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5.	On Air-dried Soil.	On Soil dried at 100° C.	
O 809	Little Shoal Bay Reserve, Auckland ..	..	7·06	12·69	0·325	0·135	0·116	0·114	0·007	0·52	0·50	0·30	0·06	0·33	0·36	0·30
O 810	" "	..	4·64	4·46	0·115	0·066	0·082	0·148	0·009	0·25	0·42	0·33	0·05	0·24	0·25	0·46
O 816	Wharenui, Marlborough	..	1·74	4·50	0·088	0·237	0·039	0·035	0·040	1·17	0·80	0·25	0·10	0·02	0·02	..
O 817	" "	..	1·66	6·32	0·168	0·195	0·049	0·022	0·027	1·05	0·86	0·31	0·09	0·05	0·05	..
M 636	Park Island, Napier	..	5·76	11·60	0·473	0·397	0·199	0·214	0·060	1·28	1·37	0·74	0·15	0·04	0·04	2·81
M 651	Te Arai Settlement, Gisborne ..	..	7·80	7·86	0·495	0·216	0·099	0·063	0·032	0·84	1·32	0·71	0·13	—0·05	—0·05	0·08
M 652	" " ..	..	7·86	3·26	0·097	1·774	0·184	0·081	0·014	2·43	1·46	0·54	0·09	—0·13	—0·13	0·26
R 58	Parihaka Block, New Plymouth ..	..	7·32	22·52	0·822	0·212	0·076	0·027	0·009	2·01	0·80	0·16	0·14	..	..	..
R 60	" " ..	..	7·80	18·14	0·547	0·151	0·039	0·023	0·002	1·39	0·64	0·20	0·05	..	..	..
P 1245	Huapai, Auckland	..	1·94	6·05	0·117	0·045	0·011	0·012	Trace	0·13	0·25	0·22	Trace	..	..	..
P 1246	" "	..	7·70	13·32	0·191	0·031	0·020	0·014	"	0·17	0·20	0·14	"	..	..	..
P 399	Te Mata Road, Hawke's Bay (subsoil) ..	11·0	3·78	2·28	0·066	0·126	0·052	0·009	"	0·62	0·50	0·35	0·01	0·01	0·01	..
P 400	" " (top soil)	18·0	2·91	6·34	0·225	0·132	0·043	0·020	0·002	0·55	0·39	0·29	0·08	0·21	0·22	..
P 401	" " (subsoil) ..	10·0	3·28	2·87	0·084	0·140	0·058	0·013	Trace	0·57	0·51	0·40	0·01	0·04	0·04	..
P 402	" " (top soil)	17·0	3·75	6·82	0·221	0·150	0·066	0·017	0·002	0·66	0·45	0·30	0·05	0·18	0·19	..
L 973	Ohura River Flats	5·0	14·56	4·45	0·095	0·102	0·033	0·031	0·018	1·05	0·98	0·42	0·06	..	..	..
L 974	Tokirima	4·0	23·36	17·51	0·388	0·173	0·068	0·036	0·007	0·69	0·70	0·41	0·08	..	..	..
P 272	Ruatorea	..	7·93	14·89	0·529	0·167	0·059	0·024	0·014	0·43	0·57	0·38	0·21	0·35	0·38	..
P 273	"	..	3·82	13·34	0·445	0·094	0·034	0·041	0·018	0·53	0·61	0·42	0·10	0·45	0·47	..
P 341	Waiomoko, Gisborne	..	4·71	14·62	0·519	0·130	0·046	0·035	0·022	0·25	0·22	0·12	0·09	..	..	..
M 362	Claudelands, Hamilton	..	18·44	14·16	0·450	0·069	0·025	0·018	0·003	0·21	0·20	0·07	0·07	0·45	0·55	..
O 759	Bull's	..	8·62	8·43	0·303	0·400	0·057	0·049	0·001	1·46	1·04	0·56	0·03	0·05	0·05	..
O 714	Palmerston North	16·7	4·73	11·40	0·344	0·275	0·068	0·034	0·036	1·06	0·80	0·55	0·13	0·17	0·18	..
O 715	"	16·8	3·87	7·63	0·271	0·116	0·053	0·026	0·019	0·78	0·57	0·50	0·08	0·15	0·16	..
O 716	"	15·5	3·00	7·80	0·254	0·130	0·074	0·028	0·016	0·84	0·76	0·52	0·08	0·17	0·18	..

LITTORAL AND OTHER SOILS.—MECHANICAL ANALYSES.
(Results are percentages on air-dried soil.)

Lab. No.	Description of Soil. (Classification of United States Department of Agriculture modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.							Stones and Gravel.
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture and Loss on Ignition.	
O 809	Fine sandy loam ..	Nil	5·6	28·7	15·4	20·6	13·0	16·8	Nil.
O 810	Sandy loam	,,	13·8	47·6	8·9	12·4	9·0	8·6	,,
O 816	Coarse sandy soil ..	24·4	61·9	3·0	2·2	1·9	0·5	5·8	,,
O 817	,, ..	35·4	40·2	5·6	5·7	4·7	1·7	7·4	,,
M 636	Fine sandy loam ..	Nil	3·7	23·9	24·6	16·9	10·9	17·3	,,
M 651	Clay loam	,,	1·0	2·1	22·8	27·1	30·3	17·1	,,
M 652	Fine sandy loam ..	,,	0·7	27·6	40·2	12·1	10·1	7·9	,,
R 58	Medium sandy silt ..	3·4	24·9	14·6	14·6	10·2	2·8	29·8	,,
R 60	Fine sandy silt ..	1·2	14·2	22·3	24·3	9·0	1·2	25·9	,,
P1245-6	Not analysed.								
P 399	Sandy loam	0·4	20·0	40·5	11·6	10·0	11·1	6·0	7·0
P 400	Fine sandy silt ..	0·2	11·4	35·5	23·2	15·2	5·6	9·1	Trace.
P 401	Fine sandy loam ..	0·1	7·5	36·7	18·9	14·2	15·8	6·1	1·0
P 402	,, ..	0·1	9·3	26·4	23·7	19·8	10·0	10·3	1·0
P 973	Fine sandy silt ..	Nil	2·8	44·9	24·7	7·1	4·1	17·1	Nil.
P 974	Fine sandy loam ..	,,	2·7	10·3	26·0	16·7	8·7	35·1	,,
P 272	Fine sandy silt ..	0·2	8·5	25·7	25·8	15·8	2·6	21·6	34·4
P 273	,, ..	0·1	10·4	24·9	28·6	15·9	4·1	16·6	2·6
P 341	Not analysed.								
M 362	Silt loam	0·2	7·1	18·6	34·1	8·2	4·0	27·2	Nil.
O 759	Fine sandy silt ..	Nil	0·2	26·8	37·3	12·4	6·6	16·3	,,
O 714	Fine sandy loam ..	,,	1·7	31·7	28·9	10·5	11·8	15·4	Trace.
O 715	,, ..	0·1	5·0	33·8	29·8	12·5	8·4	11·3	,,
O 716	,, ..	Nil	1·9	31·3	34·3	11·5	11·0	10·6	,,

PUWERA AND ALBANY EXPERIMENTAL AREAS.

NOTES ON OPERATIONS, SEASON 1922–23.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

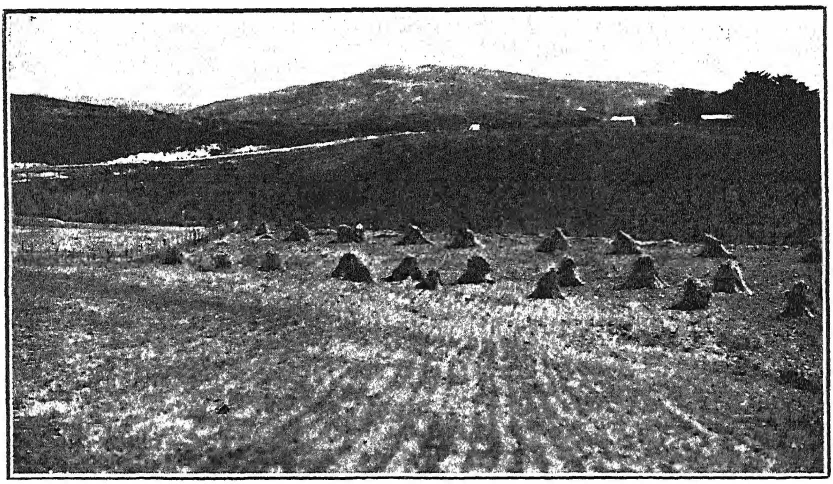
THE issues of the *Journal* for May, 1921, and December, 1922, contained accounts of the operations at the Puwera and Albany gum-land experimental areas. For details of cultivation and cropping those interested should refer to these reports. It may be repeated that Puwera is situated some eight miles from Whangarei, while Albany is near Auckland. The same general aim has been pursued on both areas—namely, the investigation of the most suitable grass-pasture for the gum lands represented, and the selection and growing of fodder crops to keep up adequate supplies of feed chiefly for autumn and winter, when pastures are not producing sufficient feed for the stock.

PASTURES.

The area under pasture at Puwera has been increased during the year. Field 3A (4 acres) was put down in permanent pasture last autumn. Half of the field, nearest the main road, was sown on 17th April with the following mixture: Perennial rye-grass (Poverty Bay), 8 lb.; Italian rye-grass, 3 lb.; cocksfoot, 12 lb.; crested dogstail, 2 lb.; paspalum, 6 lb.; white clover, 2 lb.; cow-grass (colonial), 3 lb.; chicory, ½ lb.: total, 36½ lb. per acre. The remainder of the field was sown on 30th April with the same mixture, except that the cocksfoot was cut out and the paspalum increased to 8 lb.

The first-mentioned mixture is now considered, from our experience at Puwera, to be one which will produce a good permanent pasture on this class of land. The fertilizer used, at the rate of 3 cwt. per acre, was a mixture of equal quantities of superphosphate and basic slag. The take was very fair, but the continued wet weather all through the winter and spring has had a bad effect on this area, much of which is flat and low-lying.

An additional 5 acres in tall manuka in Field 7 was cut, burnt, and surface-sown on 16th May with the following mixture: Perennial rye-grass (Poverty Bay), 12 lb.; Italian rye-grass, 4 lb.; paspalum, 5 lb.; crested dogstail, 2 lb.; cow-grass (colonial), 3 lb.; white clover, 2 lb.; Lotus major, 1 lb.: total, 29 lb. per acre. The grass has taken well, and should provide good grazing until the manuka-stumps have rotted sufficiently for the field to be ploughed.



VIEW AT PUWERA EXPERIMENTAL AREA.

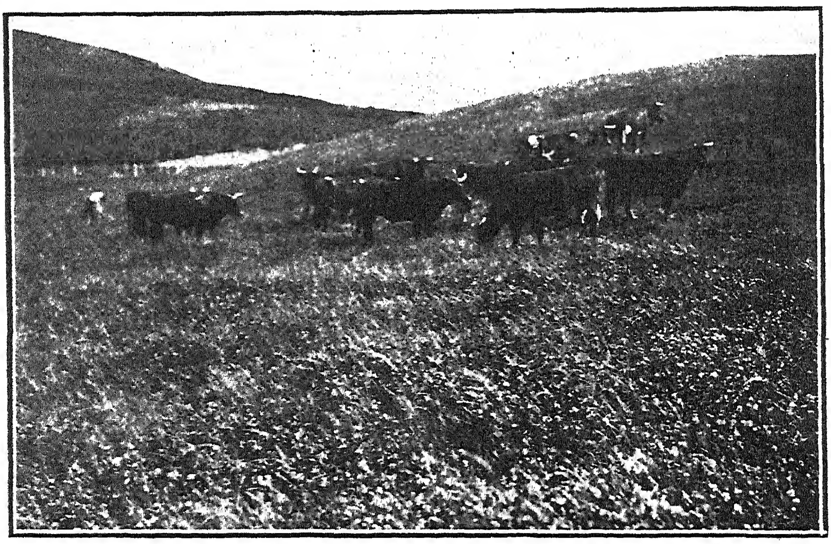
Field 3A (with oats in stook), looking across to Field 3B. Photo taken last summer, since when Field 3A has been laid down in pasture.

In Field 7 the winding creek, which drains the lower portions of Puwera, has been straightened, and the water from heavy rains is now carried away much more rapidly. Further, the under-drainage of the soil on the low-lying land of Field 7 has been materially improved by the straightening of the creek. The result has been a decided general improvement of the drainage of the whole farm, but in particular the lower portions of it.

There is now nearly 50 acres at the Puwera area in grass-pasture. It is on the various grass-fields (all of which have been sown with different seed-mixtures) that observations are being made to ascertain whether or not a profitable pasture can be maintained. A further period of some six or seven years is necessary to secure conclusive results. Beef-cattle and horses are now used to graze the areas under

trial. From an economic point of view it is conceded that it would be better to test the pastures and crops grown with a small dairy herd, as dairying on small areas may be more profitable than grazing. When more of the area is in pasture the test could be made by dairying.

The pasture on Field 3B (now in its third year) is holding very well. It consists mainly of rye-grasses, red and white clover, Lotus major, and a sprinkling of paspalum and brown-top. It has had an average annual top-dressing of basic slag at 2½ cwt. per acre. It is the best sole of grass on Puwera, and it promises to hold out, as it has shown no signs of weakening, but, on the other hand, is improving under stocking. If it can be maintained for a further six or seven years with a continuance of the rational treatment it has received up till the present, then the successful grassing of these lands will have been economically solved.



BULLOCKS GRAZING IN FIELD 3B AT PUWERA.

This photo was taken in December, 1922, and shows a fine growth of clovers in the pasture.

On Fields 5 and 6 the mixtures laid down have been carefully examined regularly. An attempt has been made to secure a paspalum sward on Field 6. The paspalum is slowly taking charge and promises to make quite a good pasture, associated as it is with white clover and Lotus major, both of which have increased in vigour and quantity, mainly on account of their response to the top-dressings of slag, which have been applied each year at the rate of 3 cwt. per acre. On the upper portion of Field 6 (3 acres) superphosphate at the rate of 3 cwt. per acre, following on a liming of ½ ton to the acre, has produced such a satisfactory growth that the area will be cut this season for hay. This portion of the field is on the ridge, the poorest area of soil on the farm.

Kikuyu-grass (Pennisetum clandestinum).

An area of 1 acre was laid down in the spring of last year with kikuyu-grass, white clover, and Lotus major. Roots of kikuyu were planted, as the grass does not seed. The roots were spaced in rows 5 ft. apart and 3 ft. between the plants in the rows. Alongside was an acre plot of paspalum with Lotus major and white clover, and another plot of prairie-grass and red clover. The kikuyu grew vigorously, and with the clover and Lotus major produced a great quantity of feed. Cattle were turned in on the plots, and they fed off the kikuyu before going on to the other plots; they relish the grass. These kikuyu and paspalum plots were top-dressed last autumn with equal parts of slag and super mixed, and when the kikuyu was inspected on 29th September it was commencing to shoot.

At Albany the area on which kikuyu and Lotus major are growing together produced excellent herbage, while plots near-by where kikuyu and white clover were growing, and kikuyu alone, were not satisfactory. The growth was poor and the turf appeared to be sod-bound. The results on these plots illustrated most strikingly the advantage of growing kikuyu with Lotus major in addition to clovers.

As seed of kikuyu-grass cannot be procured its economic value in New Zealand farming must be thereby limited. Areas have to be planted with roots. The roots, of course, could be planted with the plough as in the case of young mangold-plants. Clover and Lotus major seed can be sown broadcast on the area after the kikuyu is planted.

MANURES FOR PASTURES.

Results show that phosphatic manures are essential on these soils. Their application is followed by an increase in clovers and other legumes, while the grasses also directly benefit. Stock at Puwera, as elsewhere, show a preference for pasture on which phosphates have been applied. Basic slag, basic slag with superphosphate mixed, and superphosphate with lime all give satisfactory results. Ground raw rock phosphate, though slower in producing growth than any of these fertilizers, has nevertheless promoted clovers and improved the pasture. From trials now in progress at Puwera the increase in the weight of hay produced on permanent pasture with a top-dressing of 3 cwt. per acre of ground raw rock phosphate has been approximately 30 per cent. That was very satisfactory for the first year. The pasture had been established five years and had received no fertilizer since being seeded. Ground raw rock phosphate, mixed with superphosphate, using equal weights of each, has, from eye inspections, given much better results so far than raw rock phosphate alone. The weights of hay will be taken at the end of this year when these plots are cut.

Where the areas have been top-dressed in Field 6, the pasture of plots 6 and 8, dressed with Nauru ground raw rock phosphate and lime, still remains poor, whereas plot 7, which lay between the two last-mentioned plots, and which received pure ground rock phosphate only, has a good mixture of clovers and grasses. This is the third season that this trial of ground raw rock phosphate with and without lime has been continued.

It has been well demonstrated that a pasture at Puwera cannot be satisfactorily maintained without regular top-dressings with some kind of phosphatic manure.

Nitrogenous Fertilizers and Green-manuring.

A very striking result has been secured with an application of 1½ cwt. per acre of nitrate of soda on a new pasture of Wimmera rye-grass (*Lolium subulatum*) and red clover laid down last autumn. Early in September the grass was looking fairly vigorous, but was a pale yellowish-green colour. It was evident that it lacked available nitrogen. A month after the application of nitrate of soda was made the writer inspected the area. The plot which had received the manure stood out clearly from the rest. The colour was a dark green and the grass was more vigorous, while it was 2 in. or 3 in. taller than on the areas adjoining. Experiments at Albany with sulphate of ammonia as a top-dressing on pasture in spring gave similar results. These gum-land soils lack nitrogen, and are usually cold and wet in the winter ; they therefore respond to dressings of nitrogen in spring.

CROP OF BLUE LUPINS IN FIELD 2, PUWERA.

Collateral with this evidence may be cited the good results which are seen after a legume has been grown previously to cropping, or where organic matter is added by feeding off a crop or ploughing in a green crop. Orchardists on clay gum lands will be well advised to consider green manuring, especially as blue lupins, white mustard, and suchlike can be so successfully grown. The blue lupin crop at Puwera this season reached 4 ft. high, and was in every way a success. White lupins have not done well at Puwera. Grass-pea, serradella, and other legumes do well on these gum lands.

SUPPLEMENTARY FORAGE CROPS.

The area in grass at Puwera which was grazed or cut for hay during the season totalled 42 acres. On this were run sixteen head of cattle, four horses, and four sheep. The stock were wintered on the area and came through in good condition. Two acres were cut for

meadow hay, and 3 acres of Algerian oats for chaff; 3 acres sown in roots, mainly swedes and mangolds, were harvested. The oat crop yielded approximately 6 tons of excellent sheaves. The grain filled well, and the general quality of the material was good. The root crops, particularly the swedes and mangolds, suffered through a dry spell which commenced in the middle of January and continued till the middle of April. However, with the roots grown, together with the meadow hay and oaten chaff saved, the stock were adequately fed during the late winter, which proved long, cold, and wet.

Mangolds.

It has been shown at Puwera that an addition of 2 cwt. per acre of agricultural salt produced 9 per cent. increase in the yield of mangolds; an application of 4 cwt. per acre increased the yield 26 per cent. Nitrate of soda, at the rate of $1\frac{1}{2}$ cwt. per acre, gave no economical gain two seasons ago. Last season, however, the results favoured the addition of nitrate of soda. In addition to the general dressing of mixed fertilizer, consisting of phosphates and potash applied uniformly to the ten mangold plots, five were top-dressed at the rate of $1\frac{1}{2}$ cwt. per acre with nitrate of soda, with the following results:—

Without nitrate of soda (average of five plots): Yield 29·35 tons per acre. With nitrate of soda (average of five plots): Yield 35·07 tons per acre; gain 5·72 tons per acre, or 19·48 per cent.

It is intended to repeat these trials next season, when further data will be obtainable. The mangolds were sold at £1 7s. per ton; therefore the gain per acre of 5·7 tons represented a monetary return of £7 13s. 10d. The cost of the manure per acre was £1 7s. 6d., leaving a gain of £6 6s. 4d. per acre. This does not make allowance for labour and other costs necessarily associated with the production of the crop; but it is quite apparent that the use of nitrate of soda was decidedly profitable. Carrots and other root crops have also responded well to a dressing of nitrate of soda.

NURSERY NOTES.

A new grass known as carpet-grass (*Paspalum cupressum*), which is native to the southern United States of America, was sown in the spring of last year. In a plot side by side with *Paspalum dilatatum* the carpet-grass has so far not compared as well. Soya beans were tried, but the results were only fair. Compared with lupins, grass-pea, and other legumes referred to earlier they have not produced the same quantity of green material for ploughing-in. Kudzu has again failed at Puwera. Seed of white-fleshed swede, supplied by Mr. Langford, of Papakura, was sown in December, 1922. The crop produced was decidedly better than those of two other varieties, Masterpiece and Webb's Empire, also grown in the nursery. It withstood the dry spell which was experienced from late January until the middle of April.

Cotton was tried in the nursery at Albany. The seed was supplied by the Queensland Department of Agriculture, the variety being Durango Upland. The seed germinated well, and the plants grew to an average height of 6 in. to 9 in., while odd plants reached 3 ft. high and flowered. The flowers, however, were attacked by caterpillars,

and the damage caused by them prevented the flowers coming to maturity. Most of the crop withered and died off. The soil, which is a clay loam with a fair amount of humus present, was in good condition when the seed was sown, on 2nd November, 1922. Inter-cultivation was carried our regularly, keeping the surface mulched and clear of weeds. Maize, sorghum, millet, and elephant-grass—all subtropical plants—did well. The season was one characterized by frequent showers all through the summer and autumn, and the rainfall was above the average. This cotton crop may be considered a failure, but it is intended to try it again this season.

Pasture experiments in small plots at Albany have given some interesting results. This work, carried out by Mr. A. G. Elliott, will form the subject of some special notes at a later date.

WORKING WITH THE SPRING-TOOTHED CULTIVATOR AT PUWERA.

This implement is used freely for surface cultivation on the area. It leaves the surface somewhat cloddy, which tends to prevent a crust forming.

ROCK PHOSPHATE AND SULPHUR.

It is claimed that sulphur used in combination with ground raw rock phosphate helps to make the phosphate more readily available to crops. Plots were set out last season at Albany, and grass-pea used as the indicator crop. Legumes have a higher power of using phosphoric acid in the raw rock form than other crops. The results obtained showed that on one plot the dressing of sulphur and rock phosphate produced a decided increase in yield, measured as weights of green-stuff produced. On another area the control was equal to the sulphur-and-rock-phosphate plot. The results were sufficiently encouraging, however, for repeating the trial during the current season.

INSTRUCTIONAL WORK.

The people of the respective districts show increasing interest each year in the work on these experimental areas, this being particularly manifest in connection with Puwera. In July last the writer, at the joint request of the Whangarei Chamber of Commerce and the sub-provincial executive of the Farmers' Union, gave a lantern lecture on "Gum Lands" at the Whangarei Town Hall. There was a large attendance, including farmers who had travelled a distance of thirty miles. The boys taking agriculture at the local high school were also present. Next day the farmers and members of the Chamber of Commerce made a visit of inspection to Puwera and were conducted over the area. The day was very wet, but the attendance numbered fifty persons. Those boys of the high school who take agriculture as a subject made their annual visit to Puwera on 27th September last. Sixty-five pupils with the master and the Chairman of the High School Board and others were shown over the area and the experiments explained to them. The instructional side of Puwera is steadily growing in popularity. It is the only Government experimental area in the far North, and its general help to the farming community and others, apart from the matter of the gum-land investigation, is much valued.

LOCAL RAINFALL RECORDS.

The following tables give the rainfall at the two areas during the period covered by these notes—October, 1922, to September, 1923:—

Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Total.
PUWERA.												
Rainfall (Inches) and Number of Wet Days.												
4·10	2·65	4·89	3·24	0·92	1·95	6·61	7·78	8·04	6·50	3·19	3·05	52·92
20	12	10	4	4	7	11	21	24	19	13	12	157
ALBANY.												
Rainfall (Inches) and Number of Wet Days.												
4·04	3·56	5·99	6·44	3·85	1·76	5·73	4·12	8·95	2·81	3·19	4·00	54·54
19	17	11	10	12	8	10	26	29	19	21	22	204

Mean Annual Rainfall: Puwera, 53·9 in.; Albany, 43·8 in.

Spent Oxide from Gasworks.—This material, which can often be had for the cartage, is rich in sulphur and also in nitrogenous compounds, which when allowed to oxidize on the surface of the pasture are transferred into useful nitrogenous fertilizers. The sulphur is also of value on some soils.

Seed-testing.—During the official year 1922–23 9,056 seed-samples were tested at the Agriculture Department's seed-testing station for germination, and some 1,500 were analysed for purity. Of this number only eighty were forwarded by farmers, which may be taken as showing an increasing confidence in the ability and desire of seed-merchants generally to supply good seed. This position has arisen, firstly, from the demand by the farmer for high-class seed, and, secondly, from the efforts of the merchants to cater to that demand, and their widely adopted custom of selling on the Department's certificate.

ELECTRICITY IN DAIRY FACTORIES.*

C. VOWELL, Assoc.A.I.E.E., Grad.I.E.E., London, in the *New Zealand Journal of Science and Technology*.

THE value of electricity to mankind lies in the three main effects it is capable of producing—namely, (1) magnetic effect, (2) heating effect, (3) chemical effect.

The first, which is always present when any electric current flows, is the most important of all. Upon it depends the working of all electric bells, telephones, telegraphs, electric motors, and electro-magnetic apparatus. Electric motors alone now supply many millions of horse-power. The magnetic effect produced by an electric current is directly proportional to the current producing it—or, in other words, if the current is doubled the magnetic effect is also doubled.

The heating effect, which is second in importance, is also always present whenever an electric current flows, and is also directly proportional to the current producing it. Upon the heating effect depends all electric lighting, heating, cooking, &c., as well as the operation of the electric furnaces used for making calcium carbide, carborundum, and nitrogenous compounds for use in manures and explosives, &c.

Chemical effect: Under suitable conditions an electric current will also produce a chemical effect, which, like the others, is also directly proportional in amount to the current flowing.

In dairy factories the chief uses to which electricity may be applied are the driving of the machinery by electric motors, and the heating of water and milk. Before discussing the various methods of driving dairy-factory machinery by electricity it will be helpful to define the main electrical terms.

The electrical unit of pressure, which is analogous to pounds of pressure per square inch in steam, is the volt. One volt of electrical pressure is a little less than the pressure that would be obtainable from a single-cell battery such as is used for ringing electric bells. The unit of current is the ampere, and is analogous to the volume of steam passing through a steam-pipe. The power supplied to a steam-engine depends upon the pressure of steam in the steam-pipe and the volume of steam passing through the steam-pipe. Exactly the same is the case with electricity: the power supplied to an electric motor depends upon the current and the pressure of voltage at which that current is supplied.

For power, the unit is the volt-ampere or watt, the power in watts being the product of volts and amperes. As the volt-ampere or watt is a very small amount of electric power, a larger unit is used, known as the kilowatt, which is 1,000 watts. It will be interesting at this stage to note that 746 watts, or about three-quarters of a kilowatt, are equal to 1 horse-power.

With steam working, the amount of energy supplied by a steam-engine is measured in horse-power-hours — or, in other words, the

* Paper read before the Southland Dairy-factory Managers' Association, at Wyndham, 1st March, 1923.

horse-power developed by the engine multiplied by the number of hours it has been working. Similarly, with electric power the amount of energy supplied is measured in kilowatt-hours, or the number of kilowatts being supplied multiplied by the number of hours' duration of the supply. The kilowatt-hour is commonly known as the Board of Trade unit, and is spoken of merely as the unit of electricity.

The Southland Electric-power Board rates for electric energy, per unit per month, are as follows: For the first 21 units, 7d.; for the second 21 units, 4d.; for the following 42 units, 2½d.; for all over 84 units, 1½d.

It will be seen from this sliding scale of charges that the more electric energy consumed the lower will be the average price per unit. Take, for example, a consumer using 100 units per month: his bill will come to £1 10s., or an average of 3·6d. per unit. If he consumes 200 units per month his bill will be £2 2s. 6d., or an average of 2·55d. per unit; and if he consumes 300 units per month his bill will come to £2 15s., or an average of 2·2d. per unit. It is therefore apparent that the greater the use made of electricity the lower will be the cost per unit or per horse-power-hour.

In tests on the driving of separators by electricity and steam which were carried out recently the following methods were employed. The results are valuable, and they go to prove that dairy factories in Southland cannot afford to use steam where electricity is available at the above rates.

In the steam test half a ton of coal was carefully weighed out and reserved for use during the separating-period. The fire was worked into good condition, and 100 lb. of steam raised on the boiler. This head of steam was maintained approximately constant both before and during the separating-period. As soon as the separators were started the boiler was fired from the half-ton of coal specially reserved. At the end of the separating it was calculated that nearly a quarter of a ton of coal remained. The cost of the coal (Kaitangata) delivered into the bunker is £1 11s. per ton, and the quantity of whey separated was 3,000 gallons. Thus the coal-cost of separating 1,000 gallons of whey by steam-power works out at slightly over 2s. 7d., or 3·1d. per 100 gallons. It must be noted that the fire and boiler were left at the end of the test in the same condition as at the beginning—that is, with a full head of steam. The quantity of coal burnt in raising steam has not been added in; if it were, the cost of separating by steam-power would be still higher.

In the electric test the A.V. 6 Alfa-Laval separator was driven by an electric motor by means of Vowell's constant-tension drive. A house-service type of kilowatt-hour meter was installed to measure the quantity of electric energy consumed. The separator was run up to speed for a consumption of 0·88 unit. The speeding-up occupied 28½ minutes, the constant-tension apparatus being set for a slow acceleration.

Separating was commenced and continued for one hour, during which time approximately 600 gallons of whey were separated for a consumption of 2·59 units, or a total consumption from the commencement of speeding-up of 3·47 units. Had separating been continued for a longer period the proportion of the energy consumed in speeding-up

to that used in separating would have been less. If we neglect the energy consumed in speeding-up, the consumption of electricity per 100 gallons of whey separated works out at 0·431 unit, or, including the energy consumed in speeding-up, 0·578 unit.

In a second test 200 gallons of whey were pumped into the separator-vat, and it was found that the time occupied in separating this quantity was 18 minutes, and the consumption of electricity 0·72 unit, or 0·36 unit per 100 gallons. This does not include energy used in speeding-up.

In a third test two separators were driven by steam and one by electricity. It is assumed that the one driven electrically separated one-third of the day's total quantity of whey, which was 2,850 gallons. The total consumption of electricity, including speeding-up, was 5·08 units, or 0·53 unit per 100 gallons of whey separated. From the foregoing test the average consumption of electricity for 100 gallons of whey separated, including speeding-up, works out at 0·554 unit. Taking the last season's whey at 722,188 gallons, the consumption of electricity for separating during the nine and a half months that the factory was open would have been 4,000 units, which would have cost £33 15s. The consumption of coal chargeable to separating for that period was not less than 60·18 tons, costing £93 5s. 6d. The saving in favour of electricity is thus £59 10s. 6d., or 63·8 per cent.

ADDENDA.

On 30th May, towards the close of the season, when the supply of milk had reduced sufficiently to allow all the whey to be skimmed by one separator, the following results were obtained in a steam test using Mataura lignite (which is delivered into the bunker for 14s. 9d. per ton) for fuel.

Whey separated, 793 gallons; fuel consumed, 3½ cwt.; cost, 2s. 7d. Cost per 100 gallons of whey separated, 3·9d.

In an electric test made on 2nd June, when all the whey was skimmed by the same single separator but driven by electricity, the following results were obtained: Whey separated, 922 gallons; electricity consumed, 4·38 units; cost (estimated on probable season's consumption), 8·88d. Consumption per 100 gallons of whey separated, 0·475 unit. Estimated cost per 100 gallons of whey separated, 1d.

It will be seen that the consumption of electricity in this test is 0·079 unit per 100 gallons of whey separated less than in previous tests. This is probably due to better adjustment of the driving-apparatus. It will also be seen that the cost by steam was 0·8d. higher per 100 gallons of whey separated than in the previous test. This is due to the inherent inefficiency of collective driving, which becomes more apparent when a factory is working at part capacity. In this case only one out of three separators was in operation. The higher cost also suggests that, although the fuel being used was less than half the price of that used in the earlier test, the increased amount required renders it less economical.

It must be remembered that this is the saving in the fuel bill alone if only the separators were driven electrically. If the rest of the machinery were driven electrically the percentage of saving would

be even greater, owing to the gradually reducing price per unit charged for electricity. Other economies would be effected, such as reduced maintenance of boiler and engine, reduced renewals of belts, reduced consumption of oil, saving of labour in boiler and engine attendance, &c. The very considerable economy effected by the use of electricity is due in no small measure to the efficiency of the constant-tension drive, which has the unique function of maintaining a perfectly uniform turning effort on the pulley of the separator. Even the slight variations which would be produced by sticky or greasy patches on the belt are compensated for.

This brings out an important point in the electrification of dairy factories. Had a large motor been installed in the engine-room little or no saving would have been effected. A little consideration will make this clear. The electricity used at Wyndham is generated in Invercargill by steam-power and then transmitted a distance of twenty-seven miles. If the steam-engine is merely replaced by an electric motor of equal power its operation at Wyndham would necessitate the consumption of an amount of coal at Invercargill power-station nearly equal to that required by the present steam-engine, the only economy it would be possible to effect being due to the higher efficiency of the steam plant at Invercargill power-station as compared with the efficiency of the small steam-engine and boiler at the factory.

It is only by careful and scientific installation of motors of the correct power and specially designed for the particular machine they are to drive that the maximum economy may be obtained. Collective driving by electricity—that is, driving the whole factory by one large motor—is comparatively inefficient, although it still has to be used in the case of steam-power. Individual drive — that is, one motor for each machine or group drive, in which case two or more similar machines are grouped together and driven by one motor—is the more efficient method of applying electric-motor drive. Each method has its advantages and disadvantages, and these have to be carefully considered with relation to the cost of installation of each method.

Individual drive has the advantage of allowing of direct coupling to the driven machine, or where belting is necessary it is reduced to a minimum: this reduces maintenance and running costs in belt-renewals and oil. A further advantage is that a motor of the exact power required to drive the machine may be used. It also enables the motor to operate at higher efficiency, for the reason that electric motors, in common with other prime movers, operate most efficiently at or near their full load. Another advantage of individual drive is that the driven machines, together with their motors, may be made self-contained units. This is of great advantage where there is a possibility of the plant having to be moved or reduced in size, or where part only of the plant is required at the beginning or towards the end of the season.

One disadvantage of individual drive is that the capital cost of several small motors is greater than that of a few of larger size, giving the same total horse-power. Another disadvantage becomes of importance when the machines to be driven require only little power. This is due to the fact that small electric motors have an inherent

lower efficiency than large ones. It is on account of these two disadvantages that the group method is used. To obtain the maximum economy with group drive, only similar machines, or machines with similar operating characteristics, should be grouped together. Of these machines only those which start up and shut down at the same time should be included in one group.

The chief advantage of group drive is that fewer motors are required, which reduces capital cost; also, the motors used are larger, and therefore more efficient. Machines which occupy a large floor-space relative to the power required by them should not be grouped, as the loss of power in belts and shafting more than offsets the increased efficiency of the motor; also, the capital cost of the belts, shafting, plummer-blocks, &c., more than offsets the reduced price per horse-power of the larger-sized motors.

Electricity for heating purposes in dairy factories does not show up to the same advantage as for power. In fact, in Southland, with its abundance of lignite easily mined, electricity for heating purposes on a large scale cannot compete. The reason is that £1 worth of coal contains vastly more heat-units than £1 worth of electricity. Small-size electrical-heating apparatus, such as electric kettles, are now made with the very high efficiency of 80 to 90 per cent., which enables electricity to compete favourably with such inefficient appliances as a cast-iron kettle heated on an ordinary fire. When, however, the more efficient system of heating by high-pressure steam is used, generated by an efficient steam boiler, the cost of heating by steam is considerably lower than by electricity. It must be remembered, however, that for heating small quantities of liquid electricity is probably the next cheapest source of energy, and also possesses the great advantage of being ready for use at any time of day or night, and may be automatically regulated.

At the present time the tendency in pasteurizing is to increase the speed with which the temperature of the milk is raised and lowered. Electricity would be capable of giving a higher temperature surface than steam, and therefore could be used more efficiently than steam in a flash pasteurizer. Another use of electricity in pasteurizing or sterilizing is at present being experimented with. It consists of exposing the milk to the action of the ultra-violet rays emitted by the mercury vapour electric lamps. These rays are chemically active, and produce an effect similar to sunburn if allowed to impinge upon the skin. Sunlight is one of the best sterilizing agents, and this artificial sunlight has a similar effect.

In conclusion, I suggest that the great advantages which may be derived by using electricity to operate dairy factories behoves all dairy companies within the electrically reticulated area to give earnest consideration to the electrification of their factories. There are thus great possibilities of future development in the application of electricity to dairying.

Registration of Nurseries.—In the year 1922–23 560 nurseries were registered and inspected by the Department, and certificates issued, an increase of thirty-five as compared with the previous year; £560 was collected in registration fees.

CHAMPION JERSEY COW OF NEW ZEALAND.

PRETTY'S FLIRT PRODUCES 1,010 LB. OF BUTTERFAT.

W. M. SINGLETON, Director of Dairy Division.

AT the farm of Mr. W. H. Miers, Rukuhia, near Hamilton, the Jersey cow Pretty's Flirt has established a Dominion record for that breed in both milk and butterfat by producing 1,010·49 lb. fat from 16,684·1 lb. milk in 365 days. Pretty's Flirt calved for commencement of test on 31st October, 1922, and was then 6 years 353 days of age. Her previous calving was eleven months prior to that date, and she is expected to calve again on 6th December, which will be 12 months 36 days after her calving for start of test. The previous New Zealand champion of the breed was Sultan's Daisy, who, during the 1918–19 season, made the very fine record of 13,502·7 lb. milk and 968·22 lb. butterfat, which, however, Pretty's Flirt has now exceeded by 3,181·4 lb. milk and 42·27 lb. fat.

The production month by month of the new champion is shown in the following table :—

Month.	Days.	Milk.	Test.	Butterfat.
		lb.	Per Cent.	lb.
November, 1922 ..	30	2,007·4	4·28	85·91
December	31	2,085·5	4·89	101·98
January, 1923	31	1,815·8	5·24	95·14
February	28	1,544·9	6·79	104·89
March	31	1,526·5	6·35	96·93
April	30	1,265·9	7·46	94·43
May	31	1,154·4	6·40	73·88
June	30	1,033·0	6·86	70·86
July	31	1,117·3	6·22	69·49
August	31	1,070·8	6·78	72·60
September	30	1,008·8	6·51	65·67
October	31	1,053·8	7·47	78·71
Totals ..	365	16,684·1	6·06*	1,010·49

* On total production.

It will be seen that Pretty's Flirt's highest monthly production was for February, when her average daily butterfat was 3·71 lb.—a New Zealand record for the Jersey breed. In fairness to Pretty's Flirt it should be mentioned that she suffered considerably from foot-rot during her testing-period, which must to a certain extent have unfavourably influenced her record.

Pretty's Flirt was born on 13th November, 1915, at the farm of Mr. John Hale, Holly Oak, New Plymouth. Her sire is Exile of Oaklands, who already has ten C.O.R. daughters to his credit. Exile of Oaklands is by the imported Island-bred bull Campanile's Sultan, the sire of Sultan's Daisy and nine other daughters with certificates. The dam of Pretty's Flirt is Jersey Bank Pretty, bred by Mr. A. Hodgkinson, Takaka, and with a certificate for 611·86 lb. fat. Jersey

Bank Pretty is by Blossom's Prince from Pretty Polly (648·51 lb. fat), who in turn is by the noted sire K.C.B. Blossom's Prince goes back to Magnet's Boy, while Exile of Oaklands, the sire of Pretty's Flirt, traces to New Zealand's Exile. Thus each side of her pedigree traces to now proven strains—on the sire's side to Campanile's Sultan and New Zealand's Exile, on the dam's to Magnet's Boy and K.C.B. It would therefore seem a natural expectation that such strong blood lines must ultimately concentrate in an outstanding individual. Pretty's Flirt is an outstanding animal on type as well as production, her depth of body and udder-development being striking indications of capacity.

We have no details regarding the quantities and varieties of food fed to Pretty's Flirt while under test, but understand she received in addition to pasture nothing beyond hay, roots, green oats, and other usual farm feeds.

We hope to be able to report in next month's *Journal* that Pretty's Flirt has fully qualified for a certificate of record by calving subsequent to test, and in the meantime would extend to Mr. Miers our hearty congratulations upon the possession of a remarkable animal. Her work is also adequate testimony that she has been in the hands of a person who is capable of enabling even an outstanding cow to attain the championship of the Jersey breed in New Zealand.

PASTURE TOP-DRESSING TEST AT MARTON.

IN 1921 a small section of 2½ chains square, at Marton Junction, was divided into plots and top-dressed by the Department with several different kinds of fertilizers. The section, consisting of the typical heavy Marton soil, had been down in permanent pasture for a considerable number of years without anything in the way of top-dressing having been done. The result was that the better grasses and clovers had practically disappeared, and had been replaced by fiorin and such weeds as catsear, plantain, &c. The object of top-dressing the section was to ascertain what effect the treatment would have in bringing back the better grasses and clovers which were present to a small extent.

The section was divided into seven plots, and the manures applied carefully by hand. The following were applied—the three first in July and the others in August, 1921: (1) Ephos phosphate, at 4 cwt. per acre; (2) Nauru rock phosphate, at 4 cwt.; (3) Basic slag, at 4 cwt.; (4) Walpole Island phosphate, at 4 cwt.; (5) bone char, at 4 cwt.; (6) carbonate of lime (1 ton) and superphosphate (2 cwt.), each per acre. The seventh plot was left as a control.

All the dressings had a beneficial effect on the pasture to a more or less extent. The first to show effects was the lime-and-super mixture. When compared with the control plot the effect of the top-dressing was very marked. The section was cut for hay on 7th January, 1922. It was intended to take weighings of green material

off the respective plots, but owing to the absence of the writer from the district this was not done.

During the season 1922–23 the effect of the dressings was carefully watched, and it was noticed that the clover content of the pasture improved considerably on all plots with the exception of the control. This area had practically no bottom grasses or clovers, the bottom consisting mostly of catsear, plantain, &c. The section was cut for hay on 19th January, 1923. Prior to this, average areas were selected, and the green material off these carefully weighed. The weights per acre obtained from the respective plots were as follows: (1) Ephos phosphate, 7 tons 4 cwt.; (2) Nauru rock phosphate, 5 tons 2 cwt.; (3) basic slag, 7 tons 11 cwt.; (4) Walpole Island phosphate, 6 tons 15 cwt.; (5) bone char, 5 tons 12 cwt.; (6) lime and super, 5 tons 18 cwt.; (7) control plot, 4 tons 6 cwt.

It will be seen that all the top-dressings gave an increased yield for the second season over the control area, ranging from 18 per cent. to 75 per cent.

—*C. H. Schwass, Fields Division.*

TRIALS WITH BELL'S MERVUE SWEDE.

SOME seed of Bell's Mervue Bronze-top swede was sent to Auckland for trial in November, 1921. This variety is new to New Zealand, and two growers, Messrs. N. J. B. Dougherty and D. J. Bruce, who are dairy-farmers in the Ohura district, co-operated with the Department in carrying out a test. The soil on Mr. Dougherty's farm is a light clay loam, and the area set aside was on hilly land with a northerly aspect. On Mr. Bruce's farm the seed was sown on a heavy alluvial flat. The Ohura district is noted for its root crops, particularly swedes, the two growers mentioned being consistent winners in the root section at the Waikato Winter Show.

The trials were carried out during the past two seasons, and the average yields were as follows: Mr. Bruce's, 37 tons; Mr. Dougherty's, 32 tons per acre. The method of securing the acre yields was to weigh up three squares in different parts of the paddock, each square being an aliquot part of an acre. The squares were selected (in so far as an eye-inspection could be relied upon) to secure an average of the crop in each case. The fertilizer used was a proprietary mixture of the following composition: Insoluble nitrogen, 0·94 per cent.; phosphoric acid (P_2O_5), 16 per cent.; soluble potash (K_2O), 1·09 per cent.

The swedes were compared with three other varieties, including Superlative, and Mr. Dougherty's comment was as follows: "I grew three different kinds of swedes in areas side by side under the same conditions, and the Bell's Mervue, on the average, are equal in quality, though not quite so shapely, as the others." The combined considered opinion of Messrs. Bruce and Dougherty, after two seasons' trials, is that the new variety is not equal in their district, taking all points of view, to Superlative.

—*T. H. Patterson, Instructor in Agriculture, Auckland.*

MILKING-PREMISES FOR TOWN SUPPLY.

A GOOD MODEL.

Live-stock Division.

During the past few years the standard of dairies supplying milk for city or town consumption in the Dominion has been steadily raised, largely as the result of inspection and advice by the Department of Agriculture. There is still room, however, for considerable improvement in design and general efficiency among the ordinary run of such premises. With a view to presenting what may be regarded as a good model for the class of larger suburban dairies a set of photographs has been taken of the milking-premises of Mr. W. Huse, at his dairy farm, "Cottleville," Hayward's, in the Hutt Valley, near Wellington. These are here reproduced, together with some descriptive notes.

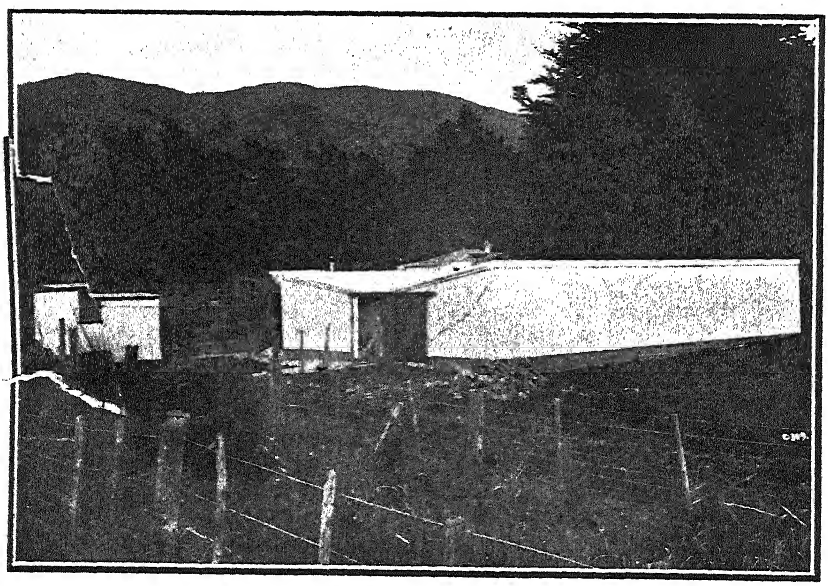


FIG. 1. GENERAL VIEW OF MR. HUSE'S MILKING-PREMISES.

Fig. 1 gives an external view of the premises, which lie practically east and west, thus affording protection against the prevailing winds and dust. For further protection a sliding-door is placed at each end. The shed is built entirely of corrugated iron and concrete, with the exception of the bail-heads and the frame, which are plated into a low concrete wall. The white building on the left is the milk-house, and

through this a permanent stream of water flows. This stream passes immediately behind the wire fence, and into it is discharged through an open concrete drain the washings from the shed. The broom seen in the photo is standing on this drain, and the effluent is immediately behind the large post in the first fence. The small shed at the rear end of the milking-shed is for washing-up, and contains a boiler and tubs for this purpose. The holding-yard is among the trees at the west end of the shed, and its floor is also of concrete. Its fence is shown at the right of the photo. A concrete race with a swing-gate leads from the holding-yard to the bails. The stall appearing as separate from the bails is for the accommodation of clean utensils just prior to milking.

Fig. 2 is an interior view of the shed, and gives a good idea of the roominess and comfort obtained. Note the leg-ropes attached to

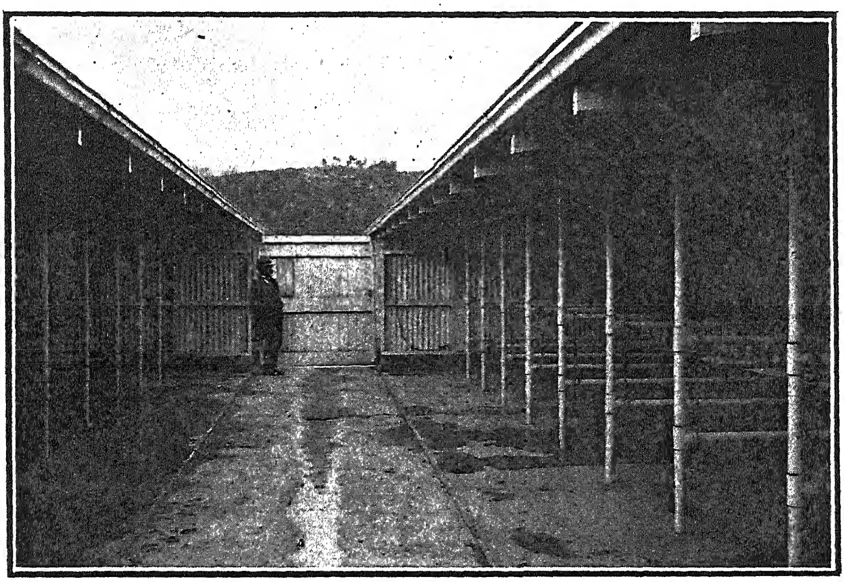


FIG. 2. INTERIOR VIEW OF THE MILKING-SHED.

rings in the ironwork, and the handles and pulleys immediately above for releasing the head-bails. On the under side of the bail-heads runs a perforated sanitary pipe, to which water is supplied immediately after milking. This sprays the floor, which is then brushed down. The entire shed, with the exception of the concrete base, is painted white. The long roof to the centre walk affords ample protection for the milkers in wet weather. There is a small room on either side between the last bail and the outside wall at the eastern end. One of these rooms is used for holding the milk during milking, and the other by the milkers for washing, &c.

Fig. 3 shows cows in the bails feeding from movable boxes. These are preferable for sanitary reasons to the permanent feeding-box. The

water for washing-down purposes was turned on for two or three minutes before the cows were bailed up.

Fig. 4 was taken to show the race from the holding-yard, the gate to the yard being closed to allow the cows that are milked to pass along another concrete race placed just outside the holding-yard, and so to the open. This race turns to the left and at right angles to the main race. By this system during the wettest of seasons no dirt or mud is brought into the milking-shed. The fall from the rear walls to the centre is only 2 in., and as each cow has ample space to turn there is no falling or slipping in the shed.

Fig. 5 is a view in the milk-house. The milk before going into the cans is put over a cooler, and the cans are then placed in the trough,

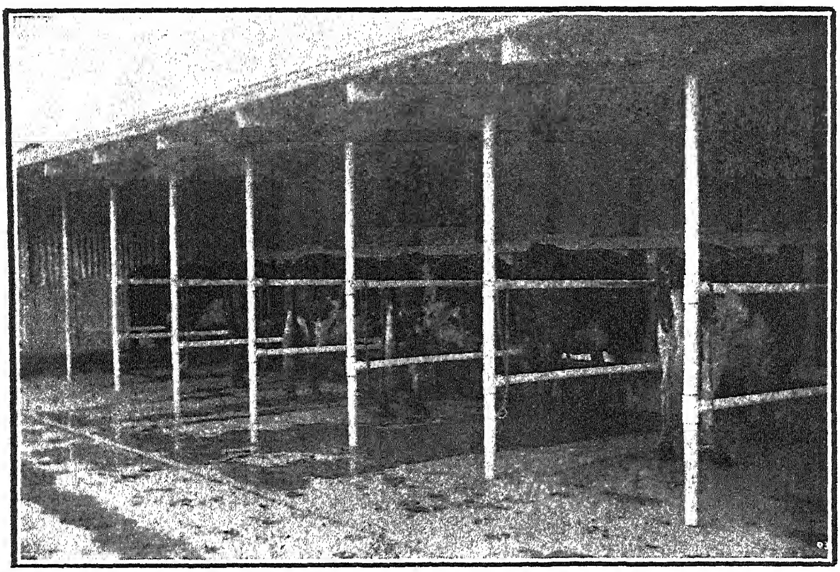


FIG. 3. COWS IN BAILS FEEDING FROM MOVABLE BOXES.

through which water is continuously flowing. The walls are lined with glazed tiles, and ample air is provided through glass louvred windows. A rail is provided for the milking-buckets and metal plunger.

GENERAL.

Following are the principal measurements of the shed: Total length, 50 ft.; total width, 35 ft.; height of rear walls, 9 ft. inside to floor; height of roof from floor at lowest elevation, 7 ft.; head-space, 2 ft. 6 in.; space for each cow, 4 ft. 5 in.; length of rail separating cows, 8 ft. 3 in.; centre walk (open), 6 ft.; fall from rear wall to centre, 2 in.

The shed accommodates twenty cows and cost £750, of which £50 was spent on painting. The design is capable of being either extended or reduced or otherwise adapted to suit varying requirements or means.

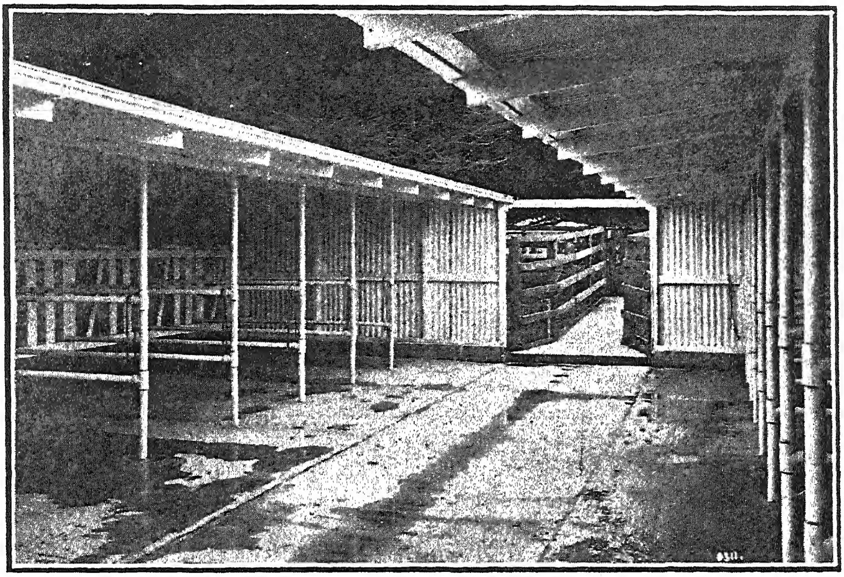


FIG. 4. SHOWING RACE FROM HOLDING-YARD TO MILKING-SHED.

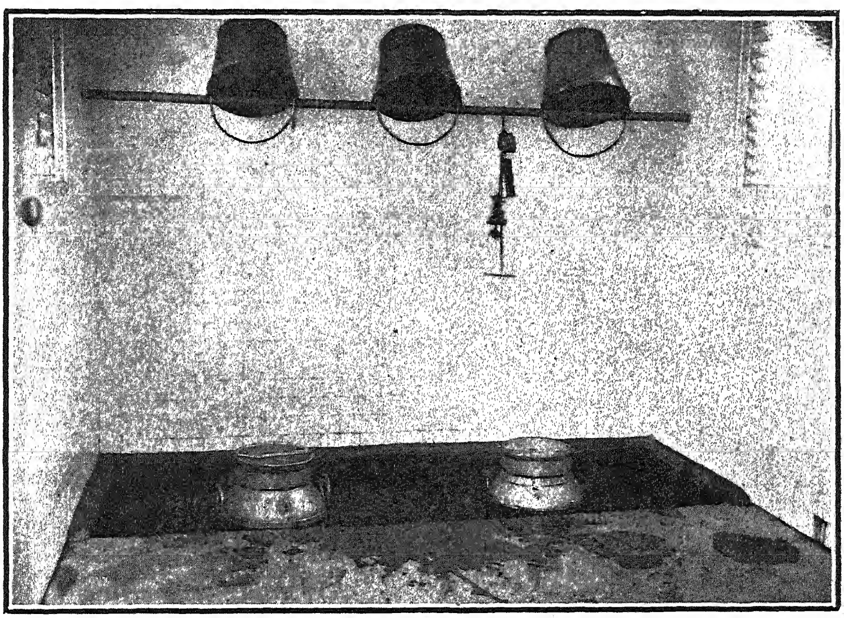


FIG. 5. VIEW IN THE MILK-HOUSE.

TESTING OF PUREBRED DAIRY COWS.

OCTOBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE appended list comprises the record of cows which received certificates during October, 1923. The list is a particularly strong one from the point of view of individual records. Each breed is represented by more than one worthy performance, and there are no fewer than nineteen cows credited with over 600 lb. of butterfat.

BAINFIELD 27TH.

The record which calls for special attention is that of the Friesian cow Bainfield 27th, which has been granted a certificate for 910·74 lb. butterfat from 23,203·3 lb. milk. This constitutes a record for the Dominion in both milk and fat for any cow of the senior four-year-old class, the yield of Mr. H. R. Green's Buttercup 3rd of Ashlynn, the former holder of the title, being exceeded by the substantial margin of 2,509·05 lb. milk and 77·48 lb. fat.

Bainfield 27th was entered for test by Mr. W. Y. Dickie, of Mataura, and after running for fifty-four days was sold to Mr. C. H. Potter, of Pukerau, at whose father's farm she completed the remaining 311 days of her period, calving subsequent to test almost exactly fourteen months after her calving for commencement. That she was well handled during her term under test there is no doubt, and much credit is due to those who piloted her through.

The sire of Bainfield 27th was Mr. W. D. Hunt's Bainfield Dutchman, who was sired by Longbeach Major, bred by Mr. J. H. Grigg, of Longbeach, from Oakwood Topsy (693·66 lb. fat), bred by Mr. Gladstone Robinson, of Gleniti. Longbeach Major is the sire of four certificated daughters apart from the cow under review, and two of these have produced over 600 lb. of butterfat. The dam of Bainfield 27th is Oakwood Daisy Bell (also bred by Mr. Robinson), with a certificate for 496·12 lb. fat as a senior two-year-old. Almost every name occurring in the pedigree of Bainfield 27th for four generations back is a name that is well known to followers of the Friesian breed, and almost every sire, at least, has proved his worth—there being in addition to Longbeach Major, already mentioned, Friesland Colantha Lad (four C.O.R. daughters), Dutchman (four C.O.R. daughters), Alfonso (sire of Oakwood Topsy, with 693·66 lb. fat), King Segis Wild Rose Homestead (sixteen C.O.R. daughters), and Rozine's Butter Boy (four C.O.R. daughters). Of the seven dams included in those four generations six have been tested and received certificates of record, their yields being 483·16, 414·51, 458·66, 508·06, 496·12, and 693·66 lb. butterfat.

From the foregoing two facts are apparent: In the first place Bainfield 27th is the result of a long line of successful matings of proven individuals, and in the second it is once more made clear that New Zealand has much to be thankful for in the wisdom of its early selectors of purebred dairy stock.

LIST OF RECORDS.

Name of Cow and Class.	Tested by	Age at start of Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Penrose Arrabelle ..	J. B. Clemow, Stratford	2 15	242·0	365	9,490·6	575·60
Sultan's Topsy ..	J. H. Sherrard, Otaua	1 362	240·5	365	9,968·2	559·55
Waionui Kate ..	A. J. Dempsey, Hamilton	1 267	240·5	365	8,390·9	502·20
Rioter's Gavotte's Pet	W. A. Guy, Matapu	1 362	240·5	365	6,788·9	494·94
Marshland's Pride ..	W. J. Chynoweth, Pukeroro	1 296	240·5	365	7,080·2	469·08
Holly Oak Florence	H. J. Addenbrooke, Ngaere	2 14	241·9	365	8,302·2	466·39
Marshland's Primrose	W. J. Chynoweth, Pukeroro	2 4	240·9	365	7,422·9	461·63
August Blossom ..	R. Dunn, Auroa ..	2 9	241·4	365	7,012·7	458·06
Gowanbrae K.C. Lady Belle	W. A. Maddox, Richmond	1 321	240·5	365	9,246·7	450·26
Marshland's Golden Lady	W. J. Chynoweth, Pukeroro	1 363	240·5	365	8,051·0	449·78
Majesty's Belle ..	H. J. Addenbrooke, Ngaere	2 19	242·4	365	8,354·7	449·66
Holly Oak Prairie Maid	M. V. Reeve-Smith, Aria	2 48	245·3	365	7,649·1	449·61
Bridge View Nettie	G. A. Gamman, Marton	1 326	240·5	365	7,222·2	441·11
Gowanbrae Dairymaid	R. Harrison, Richmond	1 360	240·5	327	8,259·3	440·76
Holly Oak Peeress ..	A. J. Miller, Uruti ..	1 304	240·5	365	7,384·3	439·70
Bridge View Sunflower	A. L. Hooper, Mahoe	1 308	240·5	333	8,694·6	431·62
Snowview's Dairylike	T. W. Perger, Brixton	1 321	240·5	324	8,235·8	427·50
Jersey Brae Finance	Thos. Church, Te Rapa	2 1	240·6	361	7,393·3	424·07
Haruru	J. S. T. Short, Hawera	2 47	245·2	343	7,644·6	418·45
Penrose Breeze ..	J. B. Clemow, Stratford	2 33	243·8	365	7,968·6	409·46
Sweet Nancy ..	J. Magill, Normanby	1 354	240·5	361	7,988·6	409·29
Maori Fussy ..	A. C. Lovelock, Woodville	2 17	242·2	363	7,741·1	408·94
Jersey Brae Ruby ..	Thos. Church, Te Rapa	1 330	240·5	365	8,378·9	400·29
Onaero's Gipsy Queen	Frank Ranford, Stratford	1 302	240·5	354	7,512·0	381·90
Fernaig Folly ..	R. F. Wilkinson, Pukekohe	1 288	240·5	346	7,011·1	381·47
Jersey Brae Fox's Queen	Thos. Church, Te Rapa	1 350	240·5	365	6,667·5	380·60
Jersey Brae's Fairy	A. R. Clark, Hamilton	1 347	240·5	365	6,089·8	368·62
Fernaig Fay ..	S. C. Colmore-Williams, Dargaville	1 225	240·5	365	5,666·4	358·88
Awaroa Lady ..	George Bright, Otaua	2 37	244·2	360	6,720·4	358·16
Ruby's Pet ..	R. Hicks, Hawera ..	1 297	240·5	365	5,583·3	356·74
Craigalea's Pearl ..	J. G. Robertson, Eltham	2 45	245·0	316	5,840·9	348·87
Jersey Brae Lady ..	Thos. Church, Te Rapa	2 6	241·1	349	6,537·0	339·55
Onaero Rosebud ..	Frank Ranford, Stratford	2 79	248·4	316	6,304·0	337·25
Rosendale's Natalie	R. J. Ballantine, Normanby	1 357	240·5	365	5,916·7	332·22
Belvedere Olga. ..	J. A. Pettigrew, Pihama	1 358	240·5	317	5,605·7	331·84
Craigalea's Beauty ..	J. G. Robertson, Eltham	2 40	244·5	299	6,918·9	331·19
Silverdale Garnet ..	G. Hodgson, Whakapara	1 289	240·5	365	5,403·4	321·11

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
				JERSEYS—*continued.*		
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Fair View Magnet ..	T. Linn, Mangatoki	2 19	242·4	307	5,128·5	318·69
Waipiko Maud ..	W. P. Begg, Aiapohue	1 335	240·5	339	6,224·8	318·12
Onaero's Marjorie ..	Frank Ranford, Stratford	2 37	244·2	312	6,852·1	311·68
Fair View Cream ..	T. Linn, Mangatoki	1 353	240·5	345	5,451·5	310·10
Zenana	A. R. Clark, Hamilton	1 334	240·5	365	6,076·8	309·23
Onaero's Clematis ..	Frank Ranford, Stratford	2 16	242·1	321	6,308·1	307·05
Maori Sally ..	G. R. and H. Hutchinson, Auckland	2 5	241·0	337	5,613·1	305·50
Holly Oak Merry Moments	John Hale, New Plymouth	2 64	246·9	257	5,105·0	304·84
Craigalea's Tobina ..	J. G. Robertson, Eltham	1 326	240·5	286	4,962·1	291·81
Onaero's Veronica ..	Frank Ranford, Stratford	2 11	241·6	305	5,712·7	291·61
Fair View Meadow	A. Hazelton, Waihou	2 5	241·0	287	5,861·9	291·27
Silverdale Rosette ..	G. Hodgson, Whakapara	1 223	240·5	349	5,852·8	272·69
Senior Two-year-old.						
Marshland's Stylish Princess	W. J. Chynoweth, Hamilton	2 353	275·8	365	9,927·7	715·75
Marshland's Eminent	W. J. Chynoweth, Pukeroro	2 328	273·3	365	11,596·6	712·08
Kuku's Clover Leaf	R. L. Horn, Ohau ..	2 347	275·2	365	12,707·8	592·45
Penrose Fancy ..	J. B. Clemow, Stratford	2 359	276·4	365	8,878·2	553·73
Sabean Rose ..	G. Milligan, Mangateretere	2 304	270·9	365	9,083·9	543·11
Arden's Leola ..	W. J. Chynoweth, Pukeroro	2 278	268·3	345	7,855·8	526·52
Brentwood's Snowdrop	C. A. Willis, Pukekohe	2 253	265·8	364	8,677·4	523·29
Silver Chimes ..	H. Salway, Bell Block	2 349	275·4	365	7,879·0	519·20
Glenmore Velvet ..	A. C. Lovelock, Woodville	2 325	273·0	365	10,172·7	492·52
Glenmore Violet ..	A. C. Lovelock, Woodville	2 316	272·1	365	9,453·3	465·52
Rioter's Gavotte's Beauty	W. A. Guy, Matapu	2 355	276·0	357	7,192·9	440·00
Dorrit	Oscar Monrad, Palmerston North	2 277	268·2	365	8,734·7	436·11
Holly Oaks Sisyphus	S. C. Colmore-Williams, Dargaville	2 275	268·0	364	7,121·4	424·73
Kimberley Lady ..	L. and J. Griffith, Weraroa	2 321	272·6	309	8,955·3	406·64
Meadowvale Miss Winsome	C. Meuli, Tariki ..	2 346	275·1	339	7,436·1	399·69
Riverlea's Blossom	Mrs. C. O'Callaghan, Tikinui	2 294	269·9	365	5,811·5	389·47
Rosendale's Sweet Pea	R. J. Ballantine, Normanby	2 285	269·0	357	6,029·2	368·51
Miss Mulberry ..	Mrs. C. O'Callaghan, Tikinui	2 330	273·5	279	4,612·2	275·51
Three-year-old.						
Zola of Rosy Creek	E. Joyce, Kaponga ..	3 43	281·3	365	12,478·6	741·20
Farce	E. Joyce, Kaponga ..	3 292	306·2	365	11,987·4	691·54

LIST OF RECORDS—*continued.*

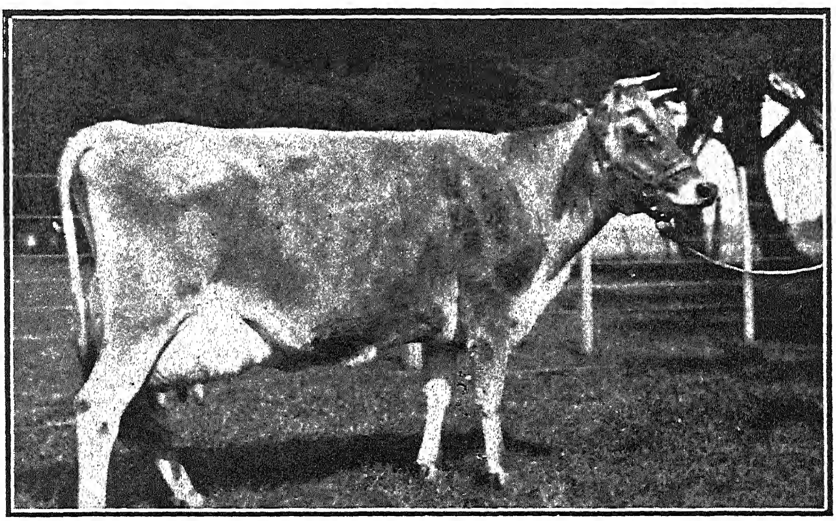
Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Three-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Norfolk Park's Bilberry	A. L. Hooper, Mahoe	3 333	310·3	365	13,252·8	631·16
Belle Olga ..	A. N. Haylock, Stratford	3 31	280·1	365	11,286·5	630·67
Kewpie	A. L. Hooper, Mahoe	3 349	311·9	355	11,509·0	593·71
Flandrine's Vixen ..	R. E. Clements, Awakino Point	3 307	307·7	365	10,338·8	574·67
Rewa Prudence ..	B. Roberts, Parkvale	3 212	298·2	365	12,083·5	549·07
Jersey Brae's Frisky	F. J. B. Ryburn, Paterangi	3 68	283·8	336	8,028·0	540·61
Brentwood's Gipsy	C. A. Willis, Pukekohe	3 328	309·8	364	8,610·3	518·42
Wisp's Beauty ..	W. Muir, Waihi ..	3 361	313·1	365	9,686·0	488·10
Kerry's Pride ..	S. J. Bright, Otaua ..	3 325	309·5	364	9,500·8	484·85
Silverdale Dot ..	G. Hodgson, Whakapara	3 68	283·8	283	9,958·0	481·75
Fancy Maid ..	A. J. Miller, Uruti ..	3 74	284·4	365	6,881·2	444·93
Hillsbourne Briar ..	G. A. Gamman, Marton	3 103	287·3	343	8,936·6	438·86
Arthingworth Princess	E. Smallbone, Richmond	3 351	312·1	365	8,242·6	419·49
Grafton Christmas Gift	S. J. Robinson, Hinuera	3 315	308·5	309	7,857·0	415·58
Silver Plate ..	F. S. Veale, Cambridge	3 20	279·0	365	7,950·4	375·95
Four-year-old.						
Jersey Meadows Iris	H. H. Phillips, Te Rehunga	4 5	314·0	365	12,478·2	752·80
Croydon's Zealandia	A. Hazelton, Waihou	4 330	346·5	365	10,832·8	569·55
Golden Bloom ..	H. J. Lancaster, Glen Oroua	4 15	315·0	365	9,832·2	568·78
Jersey Meadows Daffodil	H. H. Phillips, Te Rehunga	4 2	313·7	365	10,491·1	567·08
Liryclear's Maid ..	G. Milligan, Mangateretere	4 349	348·3	365	9,701·0	541·59
Bronze Beauty ..	D. L. A. Astbury, Mangatoki	4 36	317·1	365	7,885·2	491·39
Twylish's Primrose	D. M. Finnie, Westmere	4 44	317·9	311	8,193·5	455·96
Bright's Queen ..	George Bright, Otaua	4 25	316·0	335	7,687·3	441·80
Emerald Hill's Grace	George Bright, Otaua	4 355	349·0	365	8,139·7	403·73
Mature.						
Miss Ivy	J. Smith, jun., Palmerston North	5 3	350·0	365	10,855·4	727·62
Prim's Pearl ..	W. I. Fallows, Puni ..	8 5	350·0	364	10,700·7	667·45
Pet's Dimple ..	A. Hazelton, Waihou	5 289	350·0	365	10,331·1	641·43
Princess Fawny ..	W. I. Fallows, Puni ..	6 259	350·0	364	10,526·0	622·35
Barbury's Princess ..	A. Hazelton, Waihou	5 359	350·0	365	10,321·1	583·64
Kuku's Clover ..	R. L. Horn, Ohau ..	6 348	350·0	365	12,749·0	579·99
Neatest Darkie ..	H. J. Lancaster, Levin	6 275	350·0	365	12,321·4	544·30
Te Rapa Lass ..	T. Brownlee, Pukekohe	6 363	350·0	365	9,602·7	541·81
Cicero's Princess ..	A. E. Death, Hawera	5 45	350·0	365	8,307·0	485·70
Shamrock Sweet Joan	H. T. Mellow, Mahoe	5 40	350·0	310	9,517·8	465·00
Matai's Pride ..	S. J. Bright, Otaua	11 333	350·0	355	7,263·5	449·11
Fancy Molina ..	A. E. Death, Hawera	6 31	350·0	365	7,961·9	435·11
Foxhill Fawn ..	H. W. Nicholls, Belgrove	5 1	350·0	282	7,846·7	372·32

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at start of Test.	Fat req'd. for Cert.	Yield for Season. Days.	Milk.	Fat.
		FRIESIANS.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Pietje Fayne Colantha	John Stables, Riverlea	2 42	244·7	365	13,072·9	469·89
Alice Blanco Beets	W. H. Madill, Auckland	1 338	240·5	350	9,667·0	349·88
Senior Two-year-old.						
Dominion Wood Anemone	R. C. Allen, Annandale	2 252	265·7	365	16,821·7	587·14
Junior Three-year-old.						
Peria Romeo Lulu	J. H. Wilson, Matamata	3 27	279·7	288	8,851·6	342·98
Senior Three-year-old.						
Domino Van Buttercup	Cameron Bros., Stratford	3 323	309·3	365	17,024·2	622·47
Brookside Manor Tilly	Cameron Bros., Stratford	3 317	308·7	314	13,270·7	484·87
Senior Four-year-old.						
Bainfield 27th ..	R. J. Potter, Pukerau	4 351	348·6	365	23,203·3	910·74
Beryl de Kol of Woodlyn	T. C. Barbour, East Tamaki	4 364	349·9	365	20,627·6	648·88
Lily Last	F. Crump, Springston	4 347	348·2	365	16,519·0	615·41
Waituki Princess Burke	T. C. Barbour, East Tamaki	4 325	346·0	360	13,371·9	521·66
Grace Fayne II Van Racelands	T. H. Richards, Cardiff	4 324	345·9	357	13,401·3	434·19
Mature.						
Oakwood Betty ..	W. D. Hunt, Invercargill	6 55	350·0	340	20,712·1	756·67
Waihi Duchess ..	T. H. Richards, Cardiff	5 27	350·0	365	18,183·9	612·33
Jessie Queen of Fairburn	Fred. Crump, Springston	5 288	350·0	352	13,110·0	527·38
Milkmaid 1st Johanna	R. C. Allen, Annandale	6 316	350·0	365	15,283·4	498·80
Riverdale Flossie ..	E. F. Peacocke, Hamilton	7 271	350·0	365	16,098·1	457·24
		MILKING SHORTHORNS.				
Junior Two-year-old.						
Glenthorpe Rose ..	A. J. Melville, Buckland	1 336	240·5	331	9,043·2	338·45
Senior Two-year-old.						
Glenthorpe Ruby 3rd	A. J. Melville, Buckland	2 340	274·5	326	9,723·2	362·83
Three-year-old.						
Glenthorpe Countess 2nd	A. J. Melville, Buckland	3 11	278·1	286	8,155·8	312·66
Glenthorpe Trilby 3rd	A. J. Melville, Buckland	3 10	278·0	316	7,735·0	307·28
Mature.						
Glenthorpe Daisy ..	A. J. Melville, Buckland	..	350·0	365	14,165·4	674·46
Glenthorpe Lady ..	A. J. Melville, Buckland	..	350·0	365	16,805·2	671·63

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		AYRSHIRES.				
Four-year-old.		Yrs. dys.	lb.		lb.	lb.
May Flower of Ayrshire Downs	Litchfield Bros., Tirau	4 0	313·5	365	8,838·0	379·10
Mature.						
Sadie of Edendale ..	W. Hall, Lepperton	7 333	350·0	365	12,084·1	530·00
Braemar Fanny ..	Litchfield Bros., Tirau	7 319	350·0	365	12,874·9	529·06
Fancy of Armadale	W. Hall, Lepperton	12 8	350·0	327	11,475·2	491·26
		SHORTHORN.				
Sunnyside Princess VII	Sunnyside Mental Hospital, Christchurch.	4 83	321·8	286	6,356·6	324·91
		Second-class Certificate.				
		JERSEY.				
Senior Two-year-old.						
Maori Nell ..	J. B. Laurenson, Hawera	2 280	268·5	365	9,124·1	534·67



EATON LADY REYNECOURT (D. WATKIN, TAKANINI).

C.O.R., 1923, in Jersey Mature Class: 12,777·3 lb. milk, 871·39 lb. butterfat, in 365 days.

Winemaking.—The yield of wine in the Dominion last season is estimated at 85,000 gallons. At a reasonable estimate of 8s. per gallon this represents a value of £34,000.

SEASONAL NOTES.

THE FARM.

ROOT CROPS.

Mangolds and carrots will be making good growth in December, and every endeavour should be made to get them thinned as early as possible, so as to check weeds and let the young plants become well established before the hot weather sets in. Carrots should be thinned out to about 6 in. apart, and mangolds to 1 ft. Wider thinning is frequently recommended, but many results go to show that the spacings mentioned give the heaviest crops and the best-quality roots.

The land between the drills should have frequent cultivation, so as to encourage root-development and control weeds. For the horse-hoe the L-shaped tines with flat blades are best while the plants are young. In cultivating mangolds care should be taken not to bank the soil around the plants; on the contrary, it should be pulled away from them. If the plants are pale and showing poor leaf-growth a top-dressing with 1 cwt. of nitrate of soda after thinning will help to push them along, but if doing well they are better without the nitrate.

Further sowings of soft turnips for cow-feeding and lamb-fattening may be made early in December, and when grown for late autumn and winter feeding they should be put in towards the end of the month. Good varieties for this purpose are Green Globe and Green-top Aberdeen, or "Green-top Scotch" as they are frequently called. Green-top varieties are hardier and better keepers than purple-tops, but mature more slowly. All the Aberdeens are apt to bury themselves, and are more suitable for ridging than for sowing on the flat.

Swedes.—In districts where swedes are still a staple crop the later part of December is the best time to sow, unless early sowings have been proved by experience to be satisfactory. For example, near the coast in north-west Wellington and Taranaki it is necessary to get them in during the first half of the month, but in higher situations any time between, say, the 20th and the end of the month will be found to be suitable. The later the crop is sown, the less likely it is to be destroyed by dry-rot; on the other hand, if left too late there is the danger of dry weather and a poor strike. Superlative, Masterpiece, Magnum Bonum, Grandmaster, and Up-to-date are among the best varieties. They are all liable to attacks of dry-rot, particularly the first mentioned, Grandmaster and Up-to-date being the most resistant.

A fine, firm, moist seed-bed is essential, in order that the crop may make a good start and so stand a good chance against the "fly." From 10 oz. to 14 oz. of seed should be sown through every second coulter of the drill; the better the land and the seed-bed, the less seed required. New seed of reliable origin should always be used; old seed is very apt to be disappointing. Fertilizers should be used with the seed at the rate of 2 cwt. to 3 cwt. per acre. Most of the proprietary manures give good results, but where the farmer wishes to mix his own the following will be found very suitable generally: Half superphosphate and half either Ephos phosphate, basic slag, bone-meal, or Nauru phosphate; on old land ½ cwt. sulphate of potash per acre added to the above will in some cases be advantageous.

Care must be taken that a run-off of rough grazing will be available adjacent to the swede-paddock when the latter is fed off. Failing this, a supply of hay will be a great asset.

HAY AND ENSILAGE.

In the earlier districts crops for both hay and ensilage will be ready for cutting from the beginning of December onwards. To get the best of grass for either purpose it should be cut when the majority of plants are in bloom; if allowed to stand until the seed is ripening, the quality of both hay and ensilage will be inferior. Further, if the crop is removed at the proper time the clover

and fine grasses then come away rapidly and a good aftermath is produced. Where special crops, like oats and tares or oats and peas, have been grown for hay or ensilage care should also be taken to see that they are cut at the proper time. For hay the oats should be cut in the milky stage, and for ensilage in the dough state.

The making of ensilage is steadily coming into favour either for autumn or winter feeding, for both of which purposes it is very valuable. Apart from the good fodder saved, the cleaning-up of pastures at this time of the year helps greatly towards a succulent autumn growth. On most farms there is now a great deal of rank grass which is not palatable to stock. If this is removed before it gets too dry it makes quite good ensilage.

Until the erection of silos is more general farmers will have to rely on the pit or stack methods of ensilage. The stack has the great advantage that it can be made in the field where the material is grown; its greatest disadvantage is the labour involved, but if this is set against the labour and worry of making hay in a wet season the ensilage probably has the best of it, and the fodder saved is better.

Making Stack Ensilage.

About 40 tons is the minimum quantity of green material that it is profitable to make into stack ensilage. If the quantity is less the farmer should try a small pit. With a small quantity of material the loss around the sides in a stack is considerable, whereas if it is put into a pit it can be covered right up and the loss reduced to a minimum. A fair average crop of grass will produce from 6 to 8 tons per acre of green material, and special crops like oats and tares 8 to 10 tons; heavy crops will give an extra 2 or 3 tons. A stack to contain 30 to 40 tons should be approximately 14 ft. by 14 ft.; 50 to 70 tons, 16 ft. by 18 ft.; 100 tons, 20 ft. by 24 ft.; and so on.

Having selected the site, the stack should be built up from 6 ft. to 8 ft. high the first day, and then allowed to stand for a day or two to allow the heat to generate up to about 130° F. After this a few feet may be added each day for two or three days, when the stack should be again spelled for a day or two. The builder is guided by the stack: if it is settling rapidly building should be continued every day, but if the settling is slight the stack should be rested, until this is satisfactory. While the stack is being built great care should be taken to see that the sides are kept, if anything, a little firmer than the centre, and the top of the stack should always be kept as nearly level as possible. Further, if there is a continuous wind from one direction there will be a danger of the heat being driven to the lee side and of the stack settling unevenly. To prevent this, hang a tarpaulin or some bags on the windy side. It is also an advantage to add from 3 lb. to 6 lb. of salt per ton of green material when building; the poorer the material, the more salt required. Salt improves the quality of the ensilage, and it is a convenient way of feeding it to the stock.

When finished, the stack should be covered with from 9 in. to 12 in. of soil, so as to exclude the air; about 9 in. at the sides, running to 15 in. at the centre, gives a good finish. If the stack is very hot and settling rapidly the soil should be put on the day following the last material. If, on the other hand, the temperature is low and settling is slow the covering is best deferred for a few days.

The best ensilage is made at a temperature between 120° and 140°. If the stack gets too hot during the process of building add more material; on the other hand, if it is not hot enough spell for a time as already recommended. Experienced persons generally discard the thermometer, but it is a very useful guide for a beginner. At the end of each day's work drive a 4 ft. length of 1 in. or larger piping down the centre of the stack; then place an ordinary milk thermometer attached to a string down this pipe. In the morning the temperature is read, and, if satisfactory, the pipe is removed and stacking proceeded with, the pipe being again placed in position at the end of the day's work.

Lucerne Hay.

Lucerne is probably the most difficult plant to convert into first-class hay. The preservation of the leaf and a certain amount of moisture is essential if the green colour is to be retained. Too much moisture, however, is sure to result in heating, and a fusty hay. If weather permits, and the crop is not too heavy, the whole operation may be completed in three or four days. In the event of a heavy

crop, lucerne should be dried out in small cocks rather than big ones. Should rain fall on the small cocks less damage will be done than if it fell on big ones.

Where lucerne is planted in rows and used for haying purposes it is not advisable to intercultivate after every cut, as dirt is sure to get in the subsequent cut of hay. Proper attention to autumn and spring cultivation should be sufficient to keep the stand clean. Where the stand is used as a grazing proposition, grubbing after each grazing could be resorted to for keeping the surface free from weeds and forming a mulch.

PASTURES.

Under Canterbury conditions the ordinary rye-grass and red-clover pasture becomes hard and unpalatable in December. It has been noticed that several farmers in that district are safeguarding themselves by providing a pure cocksfoot, dogstail, and white-clover pasture, and keeping it shut up till the cocksfoot gets away. This feed then fits in nicely with the usual summer shortage, as grazing on such pasture can be commenced at the end of November. Western Wolths rye-grass, February-sown, gives the most satisfactory feed for October.

GREEN FORAGES AND POTATOES.

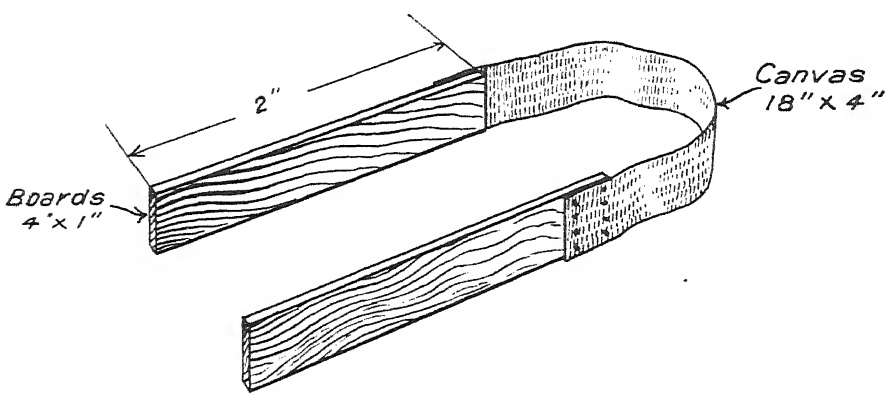
Most of the rape will now be in, but where this crop is favoured for late feed additional sowings can now be made. Late sowings of millet or maize for fodder may be completed in December.

The harvesting of the earlier potato crops will be in full swing, while the later plantings will need earthing and weeding. Potatoes, like mangolds, require a good deal of labour, but generally give a handsome return for it.

—*Fields Division.*

PREPARING LAMBS' WOOL FOR MARKET.

The difficulty usually experienced by the fleece-picker in "gathering" lambs' wool on the shearing-board can be overcome by using the simply made device shown in the illustration. The contrivance is made with two pieces of 4 in. by 1 in. boarding, each 2 ft. long. Having planed all sides to make them smooth, the two boards or battens are connected by tacking on at one end of each a piece of canvas or sacking 18 in. long and 4 in. wide. When the lamb is shorn and



the wool is on the floor the fleece-picker takes the free end of each board in each hand, spreads the boards apart so as to allow them to come on the outside of the wool, then closes the boards towards each other. This quickly gathers the wool between the boards and canvas, and it can then easily be carried away and tossed on the wool-table.

Previous to putting lambs' wool on the table the latter should be covered with a piece of hessian or sacking in order to prevent locks going through. When the wool is put on top of this it can be quickly sorted into its different

lots. All the best even-quality, clean, well-grown wool should be put into the first or A grade. Any very short, slightly discoloured wool or trimmings from low down on the legs go into the second or B grade. Any wool stained either by excreta or urine should be put into the third line, marking it "Stained pieces." When sorting according to spinning-quality it is necessary to keep each of the following as separate lines: 36's, 40's, 46's, 50's, and 56's. Very little of the two latter counts are shorn as lambs, the majority being from 40's to 46's (mostly Romney or Romney cross). Too many lines should not be made, but Lincoln or Lincoln crossbred must be kept separate from any other better-quality wool. Too often all these wools are found mixed together; this is an unwise proceeding, as the producer does not receive the best price for his best wool, which he would have done had the different qualities been kept separate.

Then, there is the wool carrying seed, such as piripiri (hutiwai), horehound, burr clover, and Bathurst or Australian burr, which must be kept separate from clean wool. This cannot be emphasized too strongly, and such wool must always be entered in the wool-book as "seedy," so that there is no chance of its ever being put up for auction with clean wool. As regards leaves of trees, gorse, broom, fern, &c., these do not affect the wool in the same way, because they crumble to dust during the process of sorting, scouring, drying, dyeing, and blending of colours to which wool is subjected prior to the manufacturing process. To destroy the seeds and burrs previously mentioned it is necessary for the wool to be carbonized.

—*J. G. Cook, Wool Instructor, Live-stock Division.*

THE ORCHARD.

FROM mid-November to mid-December thinning, cultivation, and spraying form the most important seasonable work. All of these operations play a most important part towards securing the best possible crop of fruit.

THINNING.

With fertility now definite, the number of fruits the tree is carrying may be ascertained. Should the number be very low, it should not be assumed they are not worth spraying; judicious spraying for the benefit of the tree alone will be well worth while. Should the number of fruits carried be medium, the crop will not necessarily be low in bushel capacity, as the fruits will be rather larger. One hesitates to recommend further thinning a comparatively light crop, yet there are instances where such can be done with advantage, as, for instance, with dense clusters of fruit. These are very difficult to keep clean; aphis-dirt, contact blemish, deformity of shape, and patchy low colour are intensified by such clusters. A thinning in such cases would allow better development and permit the wash of the spray to encircle the fruit.

Some nice judgment is required to decide what number should be allowed to remain on a tree where there is a heavy setting to choose from. Much, of course, depends on the typical size of the variety; one should aim at securing good specimens. Generally speaking, two fruits per spur is ample, but in the case of short-stemmed or notoriously small varieties this may be reduced to one. There are instances where this reduction of crop is not sufficient to secure a good sample; some trees spur so freely as to cause an overload to the tree even with one fruit only on each spur. In such a case the further reduction should be accomplished by removing all the fruit from maiden wood. In general practice it is better to thin twice, allowing a week or two between each operation, rather than to aim at completing the work by means of one heavy thinning. Under the former plan more latitude is allowed to determine and, as a result, discard all malformed and diseased fruit, to the ultimate benefit of the quality of the crop.

CULTIVATION.

The primary object of cultivation is to so aerate the soil that beneficial bacteria may live and multiply. Some of the other considerations are suppression of weeds, so that the trees may have the full benefit of the land, and preservation of soil-moisture. Aeration of the soil presents no difficulties where the soil is porous

or well supplied with humus, continued working with the spring-tooth or pulverizer being all that is necessary at this season. Aeration of the more tenacious soils is rather more difficult, but the first rule is not to work such soils when they are wet. The best cultivation tools for such soils are the plough and disk harrow. A shallow ploughing and immediate disking aerate heavy soils to a much greater depth than would be possible with lighter implements.

Cultivation under the tree is just as, if not more, important than on the open land. Extension disks make this possible. A thorough working of the whole surface soil will also suppress weeds and conserve moisture. During cultivation, damage is often done to trees by horse-harness, swingletrees, &c. This may be reduced to a minimum by the use of special orchard harness. There are several types to be had, all being designed to eliminate projections, which are the main cause of the damage.

SPRAYING.

Spraying-requirements for the present period are not many, but they are exacting, as only timely and thorough applications will be effective. Timely, because though there may appear to be a liberal deposit of material remaining on the trees most of this is residue, the efficiency of which, from a protection point of view, has passed away. A renewal of the sprays is therefore necessary to afford continued freedom from fungi and insects. Thorough, because the fruit is rapidly developing and exposing new surface. New wood and foliage are being added, and unless these are sprayed they are exposed to attack. Applications at twenty-one-day intervals are usually sufficient to meet requirements.

Stone-fruits will require lime-sulphur, 1–125, plus atomic sulphur, 6 lb., for brown-rot, plus nicotine, 1 pint, if black or green aphis are present. As the season is approaching for leech on plums and cherries, keep a good lookout and apply arsenate of lead, 1½ lb. per 100 gallons, should this pest appear. If the fruits are near the picking stage it is undesirable that they should be stained with arsenate, and hellebore powder, ½ oz. per gallon, should be used instead. Hellebore should be boiled for 20 minutes in a small quantity of water to prepare it for mixing.

Apples, pears, and quinces will require arsenate of lead, 1½ lb. to 2 lb. per 100 gallons, for codlin-moth, leaf-roller, and other caterpillars; lime-sulphur, 1–100, for fungi; 6 lb. atomic sulphur per 100 gallons for powdery mildew; and nicotine, 1 pint per 800 gallons, for leaf-hopper. These may be mixed, but in such a case the milk of 2 lb. of fresh-slaked lime per 100 gallons should be added. Under some unfavourable conditions as to variety, weather, or locality, lime-sulphur may not be effective in controlling black-spot, and bordeaux, 3–4–40, must then be used.

GRAFTS.

Look over grafts which were worked this season. If union has taken place, indicated by growth of the scion, sever the ties to allow expansion of the wood, but do not remove the covering.

HARVESTING AND PACKING STONE-FRUITS.

The earliest varieties of stone-fruit will soon be ready for harvest. Some definite turn towards maturity is required, but otherwise the fruits should be picked when firm. Most stone-fruits ripen to full condition very rapidly when packed in cases, and firm condition at picking-time will naturally contribute to the arrival of the fruit at its destination in good order. Such picking can best be done by going over the trees from time to time and gathering only such fruits as have reached the requisite stage of maturity. Uneven maturity in a packed case of stone-fruit is a serious though common fault detrimentally affecting the price realized. In the very early part of the season the choicest peaches are worth special packages, such as trays or punnets enclosed in a crate. At all times the fruit should be evenly sized and graded. Even with plums, the larger sizes find a better sale if packed separately from the jumble pack, this invariably applying to the main crop.

Care should be taken to protect picked fruit from the direct rays of the sun. When exposed a considerable rise in flesh-temperature takes place, some scald, and much soft rot, also wilt due to loss of moisture.

—*W. M. Rice, Orchard Instructor, Hastings.*

CITRUS FRUITS.

The main work in the citrus orchards at the present time consists of attention to efficient cultivation by means of cultivators and harrows, &c.; also the spraying of both lemon and orange trees with bordeaux, 4–4–40, for the control of verrucosis. The spraying should be done at the time when the majority of the petals have fallen from the newly formed embryo fruits. This is a most important spray and should be got on as nearly as possible at the time indicated.

STRAWBERRY-GROWING.

There will be time for little else but the harvesting of the crop at this period. The attention of growers is drawn to the necessity for the establishment of a standard pack and the honest maintenance of that pack. Only the best berries should be included in the top grade, and none but sound fruit should be sent to the market in any grade.

Those who are merely growing sufficient strawberries for their own use are advised to establish some form of protection by means of wire netting or old fishing-net to prevent depredation by birds. Where leaf-spot continues to be bad on plants a summer strength of Burgundy mixture may be applied with benefit, care being taken to pick all fruit near maturity before the application is made.

FIREBLIGHT.

Growers are again reminded that swift action is absolutely necessary in the entire removal of any part of a tree or trees affected with this disease, and the burning of the same. Any orchardist who identifies the disease in his orchard, and who is situated outside the areas where fireblight is at present known to exist, is asked to notify the local Instructor immediately and ask his advice.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

LATE-HATCHED STOCK.

It is now too late to put down sittings of hen-eggs with much prospect of the young birds ever developing into really payable stock. Yet it is safe to say that in many cases poultry-keepers, and especially those who conduct the business as a side-line, have not yet commenced their hatching operations. The fact of a chicken being hatched on the late side is all against its attaining a desired size and healthy development. Thus late-hatched chickens should be managed to the very best advantage. Of course, such stock, however well they may do, will only catch the tail-end of the dear-egg season, instead of commencing their productive period, as do the early-hatched birds, at the beginning of it. If, however, they are subjected to weak methods of management they will probably not lay till next spring, and therefore will prove non-payable stock. Every care should be given the young birds in the matter of liberal feeding, shady shelter from adverse weather conditions (especially wind), together with an abundant supply of succulent green-stuff. The reason why few farmers secure winter eggs is chiefly that they hatch their chickens at the wrong period of the year.

WAR AGAINST VERMIN.

Now is the time to make special warfare against insect vermin, which with the approach of warmer weather will multiply at an alarming rate if not constantly kept in check. It is always a weak policy to wait till the quarters become overrun with these enemies of the fowls before adopting preventive methods. The wise poultryman never allows them to make their appearance. He realizes that if these are present (especially red mite) in ever such small numbers his profits must be reduced as a consequence. It is common during my visits of instruction, when called upon to advise regarding poor egg-yields and unthrifty flocks, to ask their owners if the quarters are free from vermin. The usual reply is "Only a few." Generally, however, on making a search for the so-called few they are found in immense numbers.

Some poultry-keepers argue that it is natural for bird-life to harbour vermin when living in a natural state, and conclude that because these thrive and do well vermin should not have an injurious effect on the domesticated bird. It is here that local conditions have to be studied. Under natural conditions birds produce but few eggs during the year, and have everything in their favour for freeing themselves of vermin and retaining strong constitutional vigour. With the domesticated hen, however, it is entirely different. A bird producing 200 or more eggs a year under artificial conditions obviously cannot be expected to produce her special yield if her life-blood is being constantly drawn from the body by parasitic life.

It must not be concluded that because vermin cannot be seen with a casual glance they are not present. The most troublesome types are often the most difficult to discover. For example, the red mite, the most objectionable of all, seeks seclusion during the day in out-of-the-way corners till after dark, when it attacks the bird by blood-sucking. It thus escapes the observation of any but the keenest of poultrymen. Then, there is the depluming-mite, which causes constant irritation to a bird, and is the most common cause of feather-pulling. It is almost invisible to the naked eye, and, besides, hides in the plumage in a way that demands keen observation to disclose its whereabouts. Fleas also may cause no end of trouble in a poultry flock. They are most common where the plant is located on sandy soil. Like the red mite they mostly hide during the day and attack the birds by night. Their chief hiding-place is under the nesting-material.

Cleanliness is the great safeguard in keeping these enemies at bay. It is now recognized the world over that the most economical insurance against loss from vermin and disease in the management of poultry stock is that of cleanliness. At least twice yearly the quarters where poultry are kept should undergo a thorough cleaning and disinfection. The first step in this direction is to remove all litter and nesting-material. Then every part of the interior should be swept down with a stiff broom. It should next be thoroughly sprayed with a strong disinfectant. It is then a good plan to tar the walls, as a means of covering up all hiding-places. Remember that there is nothing like tar for keeping parasitic life at a distance. Where fowls have to be accommodated in a house soon after tarring, pieces of sacking or something similar should be tacked up against the walls until the tar dries, so as to prevent the latter getting on the feathers. To complete the cleaning of the house, and after the tar is dry, it should be given a good spraying of whitewash. Only after doing this can the house be said to be in a thoroughly clean condition.

It must not be inferred, however, that this half-yearly cleaning is sufficient. Far from it. The house should be kept clean at all times by never allowing manure, dirt, &c., to accumulate. Care also should be taken that the nesting-material is frequently changed.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FORMING NUCLEI.

With the approach of the main honey-flow and the prospect of more settled weather the beekeeper can turn his attention to the question of forming nuclei, either with an eye to artificial increase or for queen-raising purposes. Whatever the object for which they are produced the simplest method of forming nuclei is as follows :—

From the strongest colonies in the apiary take combs of sealed brood with adhering bees. Place two of these combs in each nucleus hive, together with one comb of honey and an empty comb. It is as well, if the size of the hive will permit, to add a feeder. Close the entrance of the nucleus hive by tacking over it a piece of perforated zinc or wire cloth, and place the newly formed colony in a cool place for twenty-four hours. At the end of this time the hive may be placed on its permanent stand and the entrance opened. Some of the field-bees will return to the parent hives, but in the meantime much of the sealed brood will have hatched, and thus the absconders will hardly be missed. The small colony can

at any time be given a ripe queen-cell, and under favourable weather conditions will soon possess a laying-queen.

Nuclei can be built from one or two strong colonies, each of which should produce four or five small colonies; or several hives in the apiary may each be robbed of a frame of brood, thus providing increase while leaving the full colonies practically undiminished. When the young queen commences laying in a nucleus hive she should be left in possession until she has filled two frames with eggs, when she may be removed and given to a colony which requires requeening. The nucleus should at the same time be supplied with a ripe queen-cell, and the process repeated as long as young queens are required.

REQUEENING.

The most important bee within the hive is the queen, and it is useless to expect a colony to be productive unless she is a good one. It is therefore highly essential that all colonies should be headed with prolific queens of a good strain if vigorous workers are to be raised. Queen-rearing is an important adjunct in apiary-management, and unless provision is made to requeen systematically the beekeeper will find dwindling colonies and diminished crops. Where practicable, it is advisable to requeen the colonies every year. Exception, however, must be made in the case of hives containing breeding-queens, and others retained on account of desirable drones. Where the operations of the beekeeper are such as to prevent annual requeening, provision should be made to replace half the queens in the apiary each year. If this plan is followed no colony will have queens more than two years old. With the aid of a few nuclei young queens can easily be hatched and mated, but in many cases—especially where a swarm has emerged from a hive—virgin queens can be secured and form an easy solution of the requeening problem.

No better plan can be followed by the beginner than to utilize queen-cells produced naturally—that is, under the swarming-impulse. In New Zealand it has been proved that the best months for raising queens are from November to January. During this period everything is favourable to the operation, as the hives are at their highest state of prosperity. Under normal conditions the workers and drones are at their best, this being the swarming-period. There is practically no risk of robbing; the young queens are readily accepted, and will tend to reduce swarming. Moreover, a queen introduced during the months of prosperity will produce numbers of young bees for the winter, and still be fairly young in the following spring. In the case of after-swarms, these may be sifted through an excluder placed between two empty supers, when the queen or queens can be removed. The bees will then return to the parent hive.

These young queens can be utilized for starting nuclei. It always seems a pity to destroy the young vigorous queens bred under the swarming-influence, and wherever there is an opportunity they should be saved and failing queens destroyed. A handy method of introducing virgin queens is by the smoke method. The old queen must first be removed from the hive that is to be requeened. The entrance then is contracted, and a few vigorous puffs of smoke are forced in at it. Then, before the bees have recovered from this treatment, the virgin queen is released at the entrance, piloted into the now queenless hive, and hastened therein by several more puffs of thick smoke. The hive is then closed altogether for about ten minutes, after which the entrance is once more opened slightly and left like this till the next day, when the full entrance can once more be allowed.

EXTRACTING.

Preparations for extracting the honey must be well in hand. By the time these notes are published the main flow should have started in the North, but it will depend entirely upon weather conditions. In the South the flow is fully three weeks later, and extracting rarely commences before the New Year.

It is well to get all the arrangements for handling the crop completed before the honey is sealed and ready for the extractor. It does not take a great deal of time to prepare extra supers and frames, but these are of inestimable value to the beekeeper when the main honey-flow commences. Every year immense quantities of honey are lost through lack of proper gear for handling the crop, or through the unreadiness of the beekeeper when the hives are full of honey. It is poor economy to keep one's supply so low that the bees hang about outside the hive and loaf for want of combs in which to store the honey.

Room should be provided for the workers as soon as the first honey is capped, either by extracting the combs or by supplying them with another super. Keeping the extractor running from the beginning of the honey-flow till the end is good beekeeping, provided the honey is not extracted while in an unripe condition. Although some authorities advocate leaving all the honey in the hives until the end of the season—thereby building colonies three and four stories high—the result is rather heavy work, and this method is not advisable in southern localities. Where the summer is short and variable the risk of getting the honey chilled by leaving it in the hives until the end of the season is too great. Honey, except in a few instances, is best extracted when warm from the hives. In fact, where there is any tendency to "thick" honey, extracting while the honey is warm is the only way to obviate breaking the combs in the extractor.

Comb-honey should be treated in the same way. All sections should be removed from the hives as soon as they are filled. This makes them less liable to be daubed with the propolis and to become "travel-stained" by the constant passage of the bees.

The extractor, tank, and all the rest of the gear connected with the handling of honey should be scalded and thoroughly dried before commencing the season's work. Honey, by reason of its peculiar method of production, does not call for the daily cleansing required by other foods, but it behoves the beekeeper to see that his honey-house is as trim as hands can make it. After the extractor has been scalded it should be kept covered with a clean washing cover when not in actual use, and every receptacle containing honey should receive the same treatment. These covers are easily made and washed, are inexpensive, and add much to the condition of honey as an article of food. No bees, flies, or any extraneous matter should be allowed to touch the honey once it leaves the extractor, and from the time the bees gather it till it leaves the beekeeper's hands for market his aim should be to produce a dainty and attractive article of food.

EXTRACTING APPLIANCES.

It is useless trying to work bees profitably without proper appliances. These consist of an extractor, uncapping-knives, uncapping-can, and settling-tanks. Many beekeepers make the mistake of trying to get along with any makeshifts, but experience will teach that it is a poor policy to endeavour to operate without an up-to-date equipment. However small the number of hives kept, if extracting is the objective it will be found to be most profitable to install a four-frame machine. Costing a little more at the initial outlay, it will soon pay for itself in labour-saving, and enable the beekeeper to meet the biggest flow. In any case he should not be persuaded to purchase a machine that will not reverse. Fixed machines are labour-makers, besides being messy in working. When fifty or more colonies are worked it will be found that a power plant pays for itself over and over again. Prior to the war the cost of installing a power plant was only a moderate figure, and yet relatively few of such plants are to be found in use.

Second in importance is a good tank. No apiary equipment is complete without one or two good tanks. Too little attention is paid to maturing the honey when out of the hive, and freeing it from the minute particles of wax which float on its surface. It must be left to the beekeeper to decide the size of tank he requires, this depending on his needs and conveniences. Particulars of the construction of a suitable tank to meet the requirements of an apiary of 100 to 150 colonies are given in the Department's Bulletin No. 55, "Bee-culture."

For rapid working two ordinary uncapping-knives are very convenient, but as yet no better invention has been given to the beekeeping world than the steam-heated knife. This knife obviates the necessity of constantly dipping the cold knives into hot water, and the work of uncapping can proceed uninterruptedly. There are several uncapping-cans and melters on the market, most of which are more or less satisfactory, but the perfect capping-melter has yet to be invented.

DISEASE.

If the weather conditions have not been favourable for the treatment of foul-brood this should be undertaken when the first opportunity occurs. Do not delay until the main flow arrives. Remember that if colonies are treated early enough a surplus of honey will be secured and the expense of treatment

recovered. Handling clean bees is a constant source of delight, but diseased bees are a never-ending cause of trouble. Full particulars of the treatment of disease were given last month, but if fuller information is required this is given in Bulletin No. 1, "Foul-brood in Bees," which can be obtained free from Wellington or from the Apiary Instructors in each centre.

—*E. A. Earp, Senior Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

HOEING, weeding, and thinning the main crops are operations of first importance at this period.

If the onion crop is late and there is danger of it being attacked with mildew an application of bordeaux, 2–2–40, should be made.

The seedlings of brussels sprouts, early and late broccoli, savoy, cabbage, kale, celery, and leeks should now be under way. A piece of good land, well manured, should be made ready for planting them out; frequently they follow on the early crops of potatoes and peas. Plant them out towards the end of December, planting brussels sprouts and early broccoli first. Water the beds well before lifting the plants, and remove suckers from celery-plants before planting them in the trenches.

Sweet maize should be sown now. Egg-plants (aubergines) and Chile peppers (capsicums), sweet and hot, should be planted out without delay. These interesting luxuries of the garden should be more generally grown.

TOMATOES.

Cultivation (but not too deep), pinching out laterals, and tying the plants to their supports are the chief operations for December. Should the plants need a fungicide spray, apply bordeaux, 4–4–40 (4 lb. bluestone, 4 lb. quicklime, and 40 gallons water). If more convenient 6 lb. of washing-soda may take the place of the quicklime.

THE FLOWER-GARDEN.

Here, too, special care should be taken to prevent weeds seeding. Herbaceous plants requiring support should be given early attention. Remove all seed-pods as soon as blossoms fall. About the middle of the month most garden-hedges will need trimming. Backward plants can be helped with a little liquid manure. Superphosphate, sulphate of potash, and nitrate of soda or sulphate of ammonia are water-soluble; use them sparingly, and apply only when the soil is moist.

W. C. Hyde, Horticulture Division.

Draught Stallions.—The Board of Agriculture recently decided to recommend to the Minister of Agriculture that the Bill providing for the inspection and registration of draught stallions should again be introduced. The Clydesdale Horse Society is strongly in favour of this Bill, which, states the Board, is considered by almost all breeders to be essential in order to bring about a much-needed improvement in the quality of draught horses.

Export of Honey.—The quantity of honey graded for export at the various grading-stores during the year ended 31st March last was as follows: Auckland, 5,485 cases; Wanganui, 350; Wellington, 759; Lyttelton, 1,177; Timaru, 632; Dunedin, 1,198; Bluff, 570: a total of 10,111 cases for the Dominion. This represents an increase of 1,396 cases as compared with the previous year's figures. According to Customs statistics, the quantity of honey actually exported during the year was 10,605 cwt., of a total value of £43,032.

NOXIOUS WEEDS AMENDMENT ACT, 1923.

1. This Act may be cited as the Noxious Weeds Amendment Act, 1923, and shall be read together with and deemed part of the Noxious Weeds Act, 1908 (hereinafter referred to as the principal Act).

2. Section two of the principal Act is hereby amended by omitting from the definition of the term "clear" the words "any part thereof flowering," and substituting therefor the words "the spread thereof by seeding or otherwise."

3. (1.) A local authority may at any time in manner hereinafter provided declare that any of the plants mentioned in the Second Schedule to the principal Act, except blackberry and sweetbriar, shall be deemed not to be noxious weeds within the district of that local authority or within any specified portion of that district, and every such declaration shall have effect according to its tenor.

(2.) Any declaration under this section and any declaration under section four of the principal Act, whether made before or after the passing of this Act, may at any time be in like manner amended or revoked.

(3.) Section five of the principal Act shall apply to declarations under this section in the same manner as it applies to declarations under section four of the principal Act.

4. (1.) Every occupier of land on which there are hedges or live fences consisting of barberry, sweetbriar, gorse, broom, or hakea (whether the same are noxious weeds or not) shall in every year cut or trim such hedges or fences: Provided that where such cutting or trimming would destroy the effectiveness of any hedge or live fence for shelter purposes the Inspector may, by writing under his hand, suspend the operation of this subsection with respect to such hedge or live fence for such period as he thinks fit.

(2.) Every occupier of land on which blackberry or sweetbriar is growing otherwise than in small patches shall clear so much thereof as is required by an Inspector by notice in writing under his hand. Every occupier of land on which barberry, gorse, broom, or hakea are growing otherwise than in small patches or as part of a hedge or live fence shall, in districts in which such plants are noxious weeds, clear so much thereof as is required by an Inspector by notice in writing under his hand.

(3.) Every occupier who has received a notice under the last preceding subsection may, within fourteen days of the receipt thereof, appeal to the Minister, or such person as the Minister by notice in the *Gazette* appoints in that behalf,* on the ground that the requirements of the Inspector are unreasonable.

(4.) The Minister, or the person so appointed by the Minister, shall, after inquiry, either dismiss the appeal or reduce the requirements of the Inspector, who shall, in the latter event, thereupon serve upon the occupier an amended notice in writing setting forth his requirements as so reduced. The decision of the Minister or person appointed by him, as the case may be, shall be final.

(5.) Subject to the foregoing provisions of this section, every occupier of land shall do all things necessary to clear his land and to keep the same cleared of noxious weeds.

(6.) This section is in substitution for section nine of the principal Act, and that section and section three of the Noxious Weeds Amendment Act, 1910, are hereby accordingly repealed.

5. In any case where an occupier of land takes such measures for controlling the spread of noxious weeds as may be agreed upon between the occupier and an Inspector, the Inspector may, by notice in writing under his hand, suspend or modify to the extent set forth in such notice the operation of the provisions of the last preceding section with respect to such land. Any such notice may be at any time in like manner revoked.

6. Where an occupier of land is required to cut or trim any hedges thereon, or to clear the same of noxious weeds, he shall perform those duties at such times as may be directed by regulations in that behalf, and in default of such regulations, then at the proper season of the year.

* Mr. A. R. Young, Director of the Live-stock Division, Department of Agriculture, Wellington has been appointed by the Minister under this provision.

LIVE-STOCK IN NEW ZEALAND: 1923.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1922–23.	Number of Lambs tailed, 1922–23.	Sheep (including Lambs) as at 30th April, 1923.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	38,132	39	481,253	164,993	20,883	611,221	262,824	616,749	56,227	977	1,828
Auckland	47,518	6	662,409	266,054	26,466	708,593	343,940	699,135	89,293	466	1,815
Gisborne	19,841	71	303,158	23,821	3,427	2,660,433	1,360,859	2,945,831	15,236	536	40
Hawke's Bay.. ..	17,214	8	259,436	43,720	6,641	2,442,758	1,285,004	2,769,053	14,619	156	1,015
Taranaki	21,812	4	388,880	187,818	13,940	666,679	307,203	703,944	48,564	250	4,172
Wellington	43,647	14	678,932	175,483	18,332	4,542,010	2,395,251	5,158,045	58,929	495	748
Nelson	7,851	..	64,934	24,068	3,800	384,706	145,791	405,914	12,006	828	1,228
Marlborough	7,338	1	48,010	15,635	2,133	938,111	366,627	980,870	8,209	499	1,704
Westland	2,644	8	45,359	11,134	2,139	52,131	30,854	54,370	4,062	10	32
Canterbury	62,563	33	215,306	85,648	11,683	3,707,120	2,359,085	4,393,943	56,750	116	83
Otago	35,444	21	148,954	54,030	7,859	2,461,839	1,246,236	2,921,681	20,669	5	34
Southland	26,814	..	184,063	72,267	6,669	1,244,518	791,847	1,431,904	16,325	..	34
Dominion totals ..	330,818	205	3,480,694	1,124,671	123,972	20,420,119	10,895,521	23,081,439	400,889	4,338	12,733
Totals, 1922 ..	332,105	266	3,323,223	1,015,325	121,730	21,100,550	10,267,901	22,222,259	384,333	5,904	11,576

WEATHER RECORDS: OCTOBER, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

SPRING-TIME weather, in spite of its capricious and often stormy character, is marked by increasing warmth and humidity which finds a natural response from the soil, and it must not be overlooked that both sunshine and rain are necessary for the most desirable results. Rainfall, however, is mostly associated with dull days and cool changes; and, though unwelcome to the pleasure-seeker, it is everywhere the immediate factor which spells success or failure to the farmer.

October is the middle month of spring in New Zealand, and this year it was very changeable. There were at least five westerly depressions; one, which culminated on the 24th, was severe. Three ex-tropical cyclones also passed in the North, and one which hung about East Cape from the 13th to the 19th was particularly intense about the 15th.

Rainfalls differed very greatly over the Dominion, and though mostly above the average in the northern and east-coast districts of the North Island and in North Canterbury, most other parts of the country showed a deficiency; Nelson and Westland Districts showed from 40 to 70 per cent. deficiency.

Temperatures on the whole were about the average, but the cold southerly about the middle of the month did considerable damage.

—*D. C. Bates, Director.*

RAINFALL FOR OCTOBER, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	12·98	17	2·88	4·48
Russell	4·79	12	1·06	3·27
Whangarei	4·22	14	1·80	4·58
Auckland	3·74	20	1·12	3·62
Hamilton	6·00	20	1·10	4·82
Kawhia	5·34	15	0·86	5·28
New Plymouth	5·20	19	0·98	5·47
Inglewood	9·28	20	1·54	10·09
Whangamomona	6·62	20	0·96	9·11
Tairua, Thames	6·02	13	1·62	6·89
Tauranga	6·11	23	1·45	5·36
Maraehako Station, Opotiki	5·28	11	1·10	5·50
Gisborne	3·39	12	1·10	2·84
Taupo	6·00	10	1·10	4·28
Napier	3·77	12	1·22	2·30
Maraekakaho Station, Hastings	4·95	18	1·22	2·98
Taihape	3·64	22	0·70	4·30
Masterton	4·59	19	0·96	3·34
Patea	4·56	17	0·86	4·11
Wanganui	3·45	9	0·85	3·65
Foxton	3·36	11	0·66	3·07
Wellington	3·83	16	1·11	4·15
South Island.				
Westport	2·33	16	1·05	6·97
Greymouth	4·66	15	2·26	10·66
Hokitika	8·08	17	2·98	11·74
Arthur's Pass	10·58	15	5·12	20·99

RAINFALL FOR OCTOBER, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Okuru, Westland	18·54	14	2·88	15·37
Collingwood	5·86	15	1·44	11·03
Nelson	1·67	12	0·30	3·41
Spring Creek, Blenheim	2·06	12	0·75	2·39
Tophouse	3·56	13	1·19	5·80
Hamner Springs	5·38	12	1·30	2·66
Highfield, Waiau	3·16	12	0·72	2·02
Gore Bay	3·20	9	1·40	1·80
Christchurch	1·73	10	0·78	1·65
Timaru	1·74	11	0·64	1·97
Lambrook Station, Fairlie	1·40	9	0·62	2·00
Benmore Station, Omarama	1·86	9	0·58	2·09
Oamaru	0·67	6	0·40	1·66
Queenstown	2·14	9	0·46	3·60
Clyde	1·01	7	0·50	1·58
Dunedin	3·33	12	0·85	3·05
Gore	1·91	15	0·42	3·35
Invercargill	3·12	17	0·64	4·61

FORTHCOMING AGRICULTURAL SHOWS.

Waikato A. and P. Association: Hamilton, 20th and 21st November.
North Otago A. and P. Association: Oamaru, 21st and 22nd November.
Stratford A. and P. Association: Stratford, 21st and 22nd November.
South Otago A. and P. Association: Balclutha, 22nd and 23rd November.
Otago A. and P. Society: Dunedin, 28th and 29th November.
Gore A. and P. Association: Gore, 4th and 5th December.
Auckland A. and P. Association: Auckland, 7th and 8th December.
Winton A. and P. Association: Winton, 9th December.
Southland A. and P. Association: Invercargill, 11th and 12th December.
Masterton A. and P. Association: Solway, 19th and 20th December.
Woodville A. and P. Association: Woodville, 22nd and 23rd January.
Feilding I., A., and P. Association: Feilding, 5th and 6th February.
Clevedon A. and P. Association: Clevedon, 9th February.
Rodney Agricultural Society: Warkworth, 9th February.
Dannevirke A. and P. Association: Dannevirke, 13th and 14th February.
Te Puke Agricultural Association: Te Puke, 14th February.
Whakatane A. and P. Association: Whakatane, 20th February.
Katikati A. and P. Society: Katikati, 21st February.
Rotorua A. and P. Association: Rotorua, 27th February.
Tauranga A. and P. Association: Tauranga, 28th February.
Waipu Agricultural Association: Waipu, 28th February.
Omaha and Pakiri A. and H. Society: Leigh, 1st March.
Taranaki Metropolitan Agricultural Society: New Plymouth, 5th and 6th March.
Waikato Central Agricultural Association: Cambridge, 5th and 6th March.
Morrinsville A., P., and H. Society: Morrinsville, 12th March.
King Country Central A. and P. Association: Te Kuiti, 13th March.
Mayfield A. and P. Association: Mayfield, 15th March.
Methven A. and P. Association: Methven, 27th March.
Temuka and Geraldine A. and P. Association: Winchester, 3rd April.

(Agricultural and Pastoral Association secretaries are invited to supply dates and location of their shows.)

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

CALCULATION OF LAMBING PERCENTAGES.

H. E. HARPER, Ashhurst :—

A number of farmers in this district just take the percentage of lambs from the ewes that are yarded at docking-time, not counting the ewes that have died during lambing. Others take it from the ewes that were put out with the rams. For instance, one farmer puts out 100 ewes, loses 10, and gets 90 lambs, claiming 100 per cent. Another farmer puts out 100 ewes, loses 10, gets 90 lambs, and reckons 90 per cent. Kindly advise as to the correct way of ascertaining the percentage.

The Live-stock Division :—

The correct method is to calculate the percentage of lambs on the number of ewes put to the ram. To take an extreme case : If two ewes were put to the ram and each produced twin lambs, and one ewe died in the process but the lambs lived, it would obviously be incorrect to claim a percentage of 400. The correct figure is 200 per cent. Official statistics are calculated on the number of ewes put to the rams.

MAKING BUTTER AT HOME.

"SUBSCRIBER," Pihama :—

Kindly advise me as to the best way to make butter at home from separator cream. I cannot complain about the flavour of what I make, but although I work it well it is inclined to be streaky.

The Dairy Division :—

The cream should be cooled down to as low a temperature as possible—say, 60° F. or under—as it leaves the separator. This is best done by allowing it to flow from the separator over a cooler through which cold water is passing and then into a can. The can containing the cream should be removed to a place where the atmosphere is kept fresh and cool, and left there for four to six hours to allow the fat-globules in the cream to become completely cooled. The churning may then be proceeded with. Experience has proved that to produce butter with long-keeping quality and of mild flavour the cream requires to be churned as sweet as possible and cold. Where a fuller flavour is desired and long-keeping quality is not of vital importance the cream may be allowed to sour a little before churning. A light sourness is usually present about twenty-four to forty-eight hours after separating. Temperatures much over 60° are high for churning. The lower the temperature, the firmer the butter will be, and the better it is handled without causing greasiness. The churning should be continued until the butter forms into granules about the size of wheat-kernels. The buttermilk should then be run off and replaced with a little more than an equal quantity of water of about 4° lower temperature than the cream, for the purpose of washing the butter-granules. The washing should be repeated, and the second wash-water come away almost as clear as when placed in the churn. After washing allow the butter-granules to drain for a few minutes, then place them on the worker and sprinkle the mass with salt at the rate of about 1 oz. of salt to the pound of butter. Divide the mass into three, and then form into rolls by pressing and folding each about a dozen times ; afterwards remove to a cool place, and let stand from four to six hours or longer to allow the salt to dissolve. The butter will then have a streaky appearance, and should be placed again on the worker and each roll worked about a dozen times, or until the colour is even and all traces of streakiness disappear. Probably the streakiness you speak of is due to the uneven distribution of the salt, and may be overcome by working the butter a little more.

FOWL-MANURE AND SAWDUST.

"INQUIRER," Springston :—

Further to the advice in the *Journal* for June last as to the way to preserve fowl-manure, could you tell me if the value of the manure is lost if it is mixed with straw litter, put in a heap, and allowed to rot? Would it be better if kept dry? Has sawdust any harmful effects when used as a dressing? I have heard it said that sawdust is not good for fruit-trees.

The Horticulture Division :—

The advice given in the *Journal*, and to which you refer, details the best known means of preserving fowl-manure without loss of its fertilizing properties. If mixed with straw litter it may still be valuable material. No manure can be exposed to rain without loss, as rain leaches out a proportion of the soluble contents. Some amount of moisture is necessary, however, to promote decay of the straw. If this condition can be secured the material would be best under cover. When heat is generated in the heap and vapour escapes a large amount of ammonia goes with it, and some value is lost. For this reason, if the manure is not in a fit state to allow for its immediate use, or if it is not convenient to use it at once, the heap should be turned over to check violent fermentation.

Sawdust should not be regarded as manure, nor used as such. If applied to supply humus it would be very slow in decaying, and would form shelter for woodlice and various insects. Other evils would also follow if it were used in any quantity. Authorities dealing with the utility of horse-manure where sawdust is used as bedding state that it is quite safe to use it, as it can absorb liquids that otherwise would be lost, but the dry portions should be discarded. It may be assumed that moderate amounts used in this way will be useful on any but light soils. Clean sawdust, however, could only do harm, especially to fruit-trees.

WARTS ON COW'S TEATS.

E. A. M. L., Mairoa :—

Would you be good enough to advise me of an effective method of getting rid of warts on a cow's teats and quarters? I omitted to treat the cow when it was dry. She has since come in.

The Live-stock Division :—

The only effective method to rid a cow's teats of warts is to clip the warts off with a pair of surgical scissors during the period when the cow is not milking. After the operation, when bleeding has ceased, the teats should be washed, and the spots where the warts have been should be lightly dressed with tincture of iodine. In the meantime, if a little castor-oil is occasionally smeared lightly over the teats it will have the effect of softening the warts and preventing them from becoming sore.

GETTING RID OF SILVERFISH.

A. H. S., Auckland :—

Our house is infested with silverfish, and I shall be glad if you can tell me how to get rid of them.

The Entomologist :—

As silverfish attack farinaceous matter, they may be controlled by means of poisoned flour-paste. White arsenic mixed with paste and spread on pieces of paper which are put in places frequented by the insects should attract and poison them. However, this is a dangerous practice wherever children are about. Another method is to dust infested places with sodium fluoride. If the silverfish are seriously damaging wall-paper, the latter and the scrim should be removed, and the wall-boards sprayed with crude creosote before being rescrimmed.

MAKING GREEN-HIDE LEATHER.

S. H. SMITH, Dannevirke :—

When making green-hide leather, what is the ordinary process for taking hair off the hide ? What amount of water should be used for, say, a 40 lb. hide, which would require 2 lb. of chromate and 1 lb. sulphuric acid for the first solution ? What amount of water should be used in the finishing solution—3 lb. hypo and 1 lb. sulphuric acid ? Would the amount of water used in both solutions have any effect on the finished leather ? What is the best method for making leather soft and pliable ? The weights given are taken from recipes given in the *Journal* for May and August, 1921.

The Live-stock Division :—

A solution containing lime, or lime sulphite of soda, is usually used for removing hair from hides, and you should find the recipe given in the August *Journal* for 1921 quite suitable. The hide should, however, be thoroughly washed afterwards to remove all evidence of lime. The amount of water to be added to the chemicals appears to be immaterial so long as there is enough mixture to thoroughly cover and saturate the hide. The amount of chemicals used is based entirely on the weight of the hide. After tanning, the hide requires to be partially dried and is now ready for "perching" or stretching. This is best done with a wooden crutch which has an old hoe-blade fixed. When stretched, and to make and keep the leather soft and pliable, whale-oil is then well rubbed in.

BEES AND DECAYING FRUIT.

"INQUIRER," Ettrick :—

Kindly advise me what benefit bees can get from overripe apples which have been thrown out. They gather in large numbers on any heap of apples left uncovered, and I wish to know if it is advisable to allow them to do so.

The Horticulture Division :—

Bees are attracted to overripe fruit by the juices set free at decayed spots. Where large quantities of fruit are concerned it should be protected from bees, otherwise it is likely to set up intestinal troubles in them.

HAND REARING A FOAL.

H. W. E., Maungatapere :—

Kindly advise me how to rear a foal by hand. It only had one good drink from its mother, which has since died. I have so far given it milk and water, half-and-half, with a little sugar.

The Live-stock Division :—

The complete hand rearing of a foal from birth is a matter beset with many difficulties, and necessitates extreme care and patience. In the first place it is advisable to use the milk from one cow throughout. To approximate the composition of cow's milk to that of the mare, water must be added to reduce the fat-proportion, and sugar must be used to compensate for the much smaller quantity present in cow's milk as compared with that of the mare. During the first month the proportion of water to cow's milk should be one part of the former to two of the latter. At the second month it can be used one to three, and at about three months water may be excluded. The water should be warmed to blood-heat, with a little sugar dissolved, before adding to the milk. The milk used should be as freshly drawn from the cow as possible. Cold, stale milk will cause diarrhœa. Strict attention must be paid to the cleanliness and previous scalding of milk-vessels. Feeding must be frequent—not less than once hourly after birth, extending the intervals as time goes on, but always observing regularity in time of feeding. If the foal should suffer from indigestion a little lime-water added to the milk will prove helpful, or two teaspoonfuls of baking-soda. If the foal becomes constipated this can be remedied by giving 1 oz. of castor-oil, or an enema of glycerine and water.

BLUESTONE-WATER AND PASTURE.

SIMON AND VOWLES, Moerangi :—

Is bluestone-water poisonous when it is the strength of 8 oz. to the gallon ? I use it in a foot-bath for foot-rot, and wish to know if it will poison the grass.

The Live-stock Division :—

Bluestone-water at the strength mentioned is poisonous if partaken of in any quantity. There is little danger, however, of the sheep carrying enough on their feet to render the grass poisonous, more especially if they are allowed to stand in the yard for a time before being turned into the grass.

WARTY GROWTH ON HACK'S LEG.

S. R. DICKSON, Te Rauamoa :—

A six-year-old hack has during the last twelve months developed something like a wart, nearly as big as a penny, on a hind leg between the hoof and the fetlock. It is raw, and may have been caused by striking timber, as the hack is used on bush country. Will you kindly advise me what is the best treatment ?

The Live-stock Division :—

As the growth appears to be of a warty nature and has been in existence for a considerable time, probably the best treatment would be to cauterize the part with the red iron. Afterwards apply a dressing of the following powder twice daily: Oxide of zinc, ½ oz.; boric acid, ½ oz.; iodoform, 15 grains. Keep the part covered with a bandage to protect from dirt.

CURING CALF-SKINS.

HORACE SIMON, Orakipawa :—

Would you please give me a reliable recipe for curing calf-skins with the hair intact ?

The Live-stock Division :—

The most reliable method is as follows: In 1 quart of water thoroughly dissolve 12 oz. alum, 4 oz. salt, 4 oz. oatmeal, and 2 oz. saltpetre. Rub this mixture thoroughly all over the skin on the flesh side, and fold (flesh to flesh). Allow the skin to remain for three weeks, turning once weekly. The skin should then be exposed to the wind and air until it is half-dry, when any flesh should be scraped off and the skin should be pliable. Then dry thoroughly, and it is fit for use.

Noxious Weeds.—Gorse, foxglove, and ox-eye daisy have been declared to be noxious weeds within the County of Hauraki Plains, and foxglove within Kiwitea County.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 3rd November: Peas—Market quiet and tendency lower. New Zealand Partridge stocks very heavy and selling very slowly at 60s. to 75s. per quarter; Tasmanian small spot supplies making 80s. to 85s.; English 55s. to 60s. New Zealand blue nominally £17 to £19 per ton ex store; Tasmanian £19 to £20; small business has been done with Japanese forward shipments at £20 (spot value about £23); English offering at £19 to £20; New Zealand on passage offering at £17 10s., but no business reported.

QUALITY IN FROZEN MEAT.

THE following remarks were made recently by Mr. J. Fraser, General Manager to the New Zealand Meat-producers' Board:—

"It is a better proposition for a farmer to produce high-quality mutton of medium weight than sheep running up to, say, 75 lb. In years gone by the difference on Smithfield in value between good-quality light sheep was a matter of farthings; to-day there is a difference of pence per pound, so insistent is the demand for light sheep of good quality.

"To-day a 55 lb. wether of prime quality would realize on Smithfield about 8½d. per pound, equal to 38s. 11d. per head; whereas a heavy wether weighing, say, 75 lb. would realize about 6½d. per pound, equal to 40s. 7d. per head. But, in addition to this, we must take into consideration the respective cost of placing these sheep on the Smithfield market, including killing, freezing, freight, and London charges—on a 55 lb. wether at, say, 2¾d. = 12s. 7d.; on a 75 lb. wether at the same price = 17s. 2d. On these figures, based on Smithfield prices, a 55 lb. wether works out at about 2s. 11d. more than a 75 lb. Besides this loss, the reputation of our meat is not improved by sending heavy mutton of indifferent quality.

"The same applies to beef. There is a demand for a limited amount of heavy beef, provided it is of prime quality, but what the London market wants is bullocks weighing from, say, 700 lb. to 800 lb., of prime quality, and not too old."

NEW ZEALAND DAIRY-PRODUCE CONTROL BOARD.

REGULATIONS FOR ELECTION OF PRODUCERS' REPRESENTATIVES.

THE poll of producers, taken on 17th October, resulted in the proposal that the Dairy-produce Export Control Act be brought into operation being carried by 22,284 votes against 9,255. It was then formally declared by Governor-General's Proclamation that the Act should come into operation on 3rd November. Regulations prescribing the manner of taking the votes of producers for the election of members of the Control Board under the Act were gazetted on 8th November, as follows:—

1. In these regulations "the Board" means the New Zealand Dairy-produce Control Board; "the Minister" means the Minister of Agriculture.

2. For the purpose of taking the votes of producers there shall be appointed a Returning Officer, who shall make all necessary arrangements.

3. For the purpose of the election of producers' representatives the Minister shall direct the preparation of a roll of producers for the North Island and of a roll of producers for the South Island; and such rolls shall be compiled from information furnished by each owner of a dairy factory manufacturing dairy-produce for export, and registered with the Department of Agriculture in accordance with the Regulations under the Dairy Industry Act, 1908.

4. The election of members to the Board shall close on the 13th day of December, 1923, and shall be by a system of postal voting. No voting-paper shall be valid which is not received before noon on that day.

5. No person shall be eligible for election as a producers' representative unless he has been nominated by two or more producers whose names have been submitted to the Returning Officer by the owner of any such dairy factory, and he has accepted nomination in writing, or by telegraph.

6. Nothing in the foregoing regulations shall prevent the Returning Officer from accepting a nomination-paper in such manner as, in his opinion, is sufficient to identify the candidate and nominators.

7. No producer shall be entitled to nominate more persons for election than the number of producers' representatives required.

8. The form of nomination shall be in the form No. 1 in the Schedule hereto, or to the effect thereof.

9. The last day and hour for receiving nominations shall be the 22nd day of November, 1923, at noon.

10. If no more persons are so nominated as producers' representatives than are required to fill the vacant positions on the Board, such persons shall be deemed to have been duly elected.

11. If more persons are so nominated than are required to fill the vacant positions on the Board, the Returning Officer shall cause voting-papers to be printed, in the form No. 2 in the Schedule hereto.

12. At such ballot no voting-paper shall be valid unless votes are recorded for the full number of persons required to be elected.

13. Where there is an equality of votes between any condidates and the addition of a vote would entitle one of such candidates to be declared elected, the Returning Officer shall give a casting-vote.

14. Subject to the foregoing provisions, the candidates required to be elected who have received the greatest number of votes shall be declared elected by the Returning Officer by notice in the *Gazette*.

SCHEDULE.

FORM NO. 1.—NOMINATION OF PRODUCERS' REPRESENTATIVE ON NEW ZEALAND DAIRY-PRODUCE CONTROL BOARD.

To the Returning Officer, Box 25, Government Buildings, Wellington.

We, the undersigned persons carrying on business as suppliers of milk or cream to factories manufacturing dairy-produce for export, do hereby nominate A. B. [*Full name*], of [*Residence and occupation*], with his consent, as a candidate at the election of members of the New Zealand Dairy-produce Control Board.

Dated at , this day of , 1923.

[*Full names, residence, and occupation of two or more producers.*]

I, A. B. [*Full name*], do hereby consent to the above nomination.

A. B. [*Residence and occupation*].

FORM NO. 2.—VOTING-PAPER.

New Zealand Dairy-produce Control Board: Election of Producers' Representatives to Board, 1923.

MARBLE, Roland Top.
APPLE, James Ross.

Directions.—The voter must vote for the *full number of candidates* (*six* for the North Island or *three* for the South Island); he shall leave uncancelled the names of the candidates for whom he desires to vote, *and must strike out* the names of all the candidates not voted for. Should a voter leave uncancelled the names of *more or fewer* persons than there are producers to be elected, then his voting-paper shall be invalid. A voter is only entitled to *one* vote. After indicating the vote in manner aforesaid this voting-paper is to be transmitted to the Returning Officer, Box 25, Government Buildings, Wellington, so as to be delivered at his office on or before noon on the 13th December, 1923. An addressed envelope is enclosed for use in transmitting the voting-paper.

IMPORTATION OF FERTILIZERS, SEPTEMBER QUARTER.

FOLLOWING were the importations of fertilizers into New Zealand for the quarter ended 30th September, 1923: *Sulphate of Ammonia*—United Kingdom, 300 tons; Australia, 32 tons; Belgium, 50 tons. *Gypsum*—United Kingdom, 1 ton; Australia, 356 tons. *Nitrate of Soda*—United Kingdom, 60 tons. *Basic slag*—United Kingdom, 2,300 tons; Belgium, 4,997 tons. *Bonedust*—Australia, 509 tons. *Chardust*—Australia, 50 tons. *Guano and Rock Phosphates*—New Caledonia, 1,673 tons; Ocean Island, 6,350 tons; Makatea Island, 14,273 tons. *Superphosphate*—Belgium, 5 tons. *Phosphates, other*—Egypt, 3,800 tons. *Kainit*—United Kingdom, 15 tons; France, 299 tons; Germany, 325 tons. *Sulphate of Potash*—United Kingdom, 75 tons; Belgium, 45 tons; Germany, 60 tons. *Potash, other*—United Kingdom, 25 tons; France, 50 tons. *Fertilizers, other*—United Kingdom, 3 tons.

THE SEASON'S LAMBING: NORTH ISLAND ESTIMATE.

FROM information furnished by the Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 91·34 per cent. With 7,170,154 breeding-ewes in the North Island, as shown in the 1923 sheep returns, the number of lambs is estimated at 6,549,143. The corresponding figures for last year showed a lambing percentage of 90·36 and 6,118,530 breeding-ewes. South Island and Dominion estimates will appear in next month's issue.

ESTIMATED AREAS UNDER WHEAT AND OATS.

THE following estimates of the areas under wheat and oats in the Dominion for the current season have been issued by the Government Statistician, under date 31st October, the figures being based on the usual card census: Wheat—North Island, 5,000 acres; South Island, 180,000 acres: total, 185,000 acres. Oats—North Island, 55,000 acres; South Island, 390,000 acres: total, 445,000 acres. The corresponding final totals for the previous season (1922–23) were 278,687 acres of wheat and 468,928 acres of oats. In the current season's wheat-sowings the areas under the different varieties are given as follows: Tuscan or long-berry, 124,727 acres; Hunters (various), 33,739 acres; Velvet or Pearl, 13,901 acres; balance unspecified.

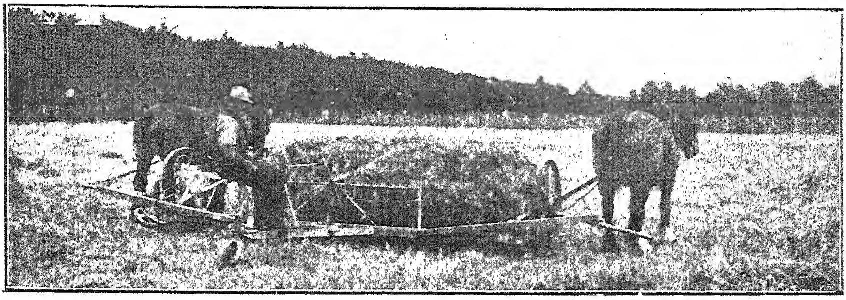
KILLINGS AT MEAT-WORKS, SEASON 1922-23.

FIGURES supplied by the Meat Control Board show the killings at all freezing-works in New Zealand for the season 1st November, 1922, to 31st October, 1923, as follows, the unit given being the 60 lb. freight carcase:—

Class.	North Island.	South Island.	Dominion.
Beef	1,241,130	9,703	1,250,833
Wether mutton	903,385	103,875	1,007,260
Ewe mutton	328,438	137,806	466,244
Lamb	1,148,081	1,592,482	2,740,563
Sundries	260,531	40,277	300,808
Totals	3,881,565	1,884,143	5,765,708
Totals, 1921–22 ..	3,898,254	2,113,443	6,011,697

Freight on Stud Pigs from Britain.—Although the shipping companies have for some little time past been carrying stud sheep and cattle freight free from Britain to New Zealand, this concession does not apply to pigs. The freight rates for pigs are £7 17s. 6d. per head up to five, and £6 6s. per head for over five.

Area under Potatoes.—The Government Statistician estimates the area under potatoes this season (1923–24) as 5,500 acres in the North Island and 11,000 acres in the South Island, or a total of 16,500 acres. The corresponding final figures for the 1922–23 season were 5,370, 14,827, and 20,197 acres respectively. Only holdings of 1 acre and over outside borough boundaries are covered by these figures. A fair aggregate area of potatoes is grown on the smaller holdings and within boroughs.



The New Zealand

Journal of Agriculture.

Vol. XXVII.—No. 6.

WELLINGTON, 20th DECEMBER, 1923.

THE DEHORNING OF CATTLE.

VARIOUS ASPECTS AND CONSIDERATIONS.

A. R. YOUNG, M.R.C.V.S., Director of the Live-stock Division.

THE subject of the dehorning of cattle was briefly reviewed in the *Journal* for January, 1918, since when a larger amount of evidence has been accumulated and the matter further considered from its different aspects. The prinicpal objections raised to dehorning have been from a "cruelty-to-animals" point of view, and that of purebred stud or exhibition cattle. Various suggestions have been put forward, and after careful consideration the Department proposes to meet these objections while also endeavouring to attain the desired object.

THE CRUELTY POINT OF VIEW.

It has been demonstrated that horned cattle are the chief cause of bruises found upon beef carcases, and this brings one to the first point for consideration—namely, whether it is a matter of cruelty to dehorn cattle. The removing of the horn "bud" from calves is a simple and practically painless operation when compared with castration, ovariotomy, or the docking of lambs. In older cattle the operation is more spectacular than cruel, due to bleeding. The operation, if skilfully performed (by this is meant sharp, clean instruments and the animal securely fixed up), is almost instantaneous, and the job once done lasts

a lifetime. On the other hand, the saving of the animal from one short pain leaves it for the remainder of its life in possession of a weapon with which it can, and generally does, inflict gross cruelty upon other animals, including human beings, whenever in a mood to do so. It may be noted here that at least one of the leading societies for the prevention of cruelty to animals has passed a resolution in favour of dehorning, preferably in the calf stage. In any case it is unlikely that proceedings taken under any legislation at present in existence would be likely to succeed, so overwhelming is the evidence that dehorning is an important factor in the prevention of cruelty to animals.

STUD OR EXHIBITION CATTLE.

Purebred cattle or cattle intended for exhibition purposes are reared and cared for under different conditions from those under which general dairy stock are kept, and the same opportunity is not allowed them for attacking their mates, which, if allowed to take place, would be disastrous to the owner intending to exhibit or sell. He is careful, therefore, to avoid any injury to his stock in this way. Another very important matter which must not be overlooked is that the dehorning of horned breeds of cattle does away with the characteristic expression of the breed the presence of which is absolutely necessary in expert judging. Such stock should therefore not be dehorned while kept for exhibition; but when such purposes have been fulfilled and it has been decided to fatten off the animals for slaughter, and they are likely to mix with other cattle in saleyards, mobs, or in railway-trucks, they should certainly be dehorned a few weeks previously.

DAMAGE TO CARCASES IN THE MEAT TRADE.

The heavy loss sustained annually, especially for the meat-export trade, by the disfigurement of carcases is well known to all engaged in the trade, while the number of wholly condemned or partially rejected carcases, even for home consumption, is astounding to those with knowledge of this matter. The most serious aspect lies in the fact that it is the best and most valuable cuts of meat which are most liable to be so damaged.

Many complaints have reached the Department indicating that careless shunting of railway-trucks in transit is the principal cause of cattle being bruised. This has been greatly exaggerated, it being no sure sign to rely upon probes as evidence that where no such marks exist all other bruises can be put down to careless shunting. One horned animal in a truck of otherwise hornless cattle can and does so frighten the others as to cause them to seriously bruise their sides and hind quarters against the truck in an attempt to save themselves from the more dreaded horn. This can be seen at any time even when the trucks are stationary. It is essential for the reduction of bruising that there be more careful handling and less stick while yarding, loading, or detraining cattle, that male and female animals be kept separate as far as possible, and that all cattle be dehorned before forwarding for slaughter.

It is not feasible to here go into all the details which have accumulated at the Division's office, but the following examples are

a fair average from among statistics supplied by departmental officers employed specially at slaughtering-places :—

In one mob of 105 horned cattle received by rail at one meat-works, examination after slaughter showed thirty-one bruised buttocks, thirty-eight bruised sides, twenty-two bruised shoulders, thirty-three bruised hips, two bruised legs, one bruised back, and fifteen horn-pokes. In this case forty-two hind quarters and twenty-six fore quarters were rejected for export.

Other reports state : " On the 16th and 18th instant there were slaughtered 111 head of Polled Angus cattle ex rail. Thirty were found bruised, mostly upon the hip, so it looks as if bruisings were done in yards or elsewhere."

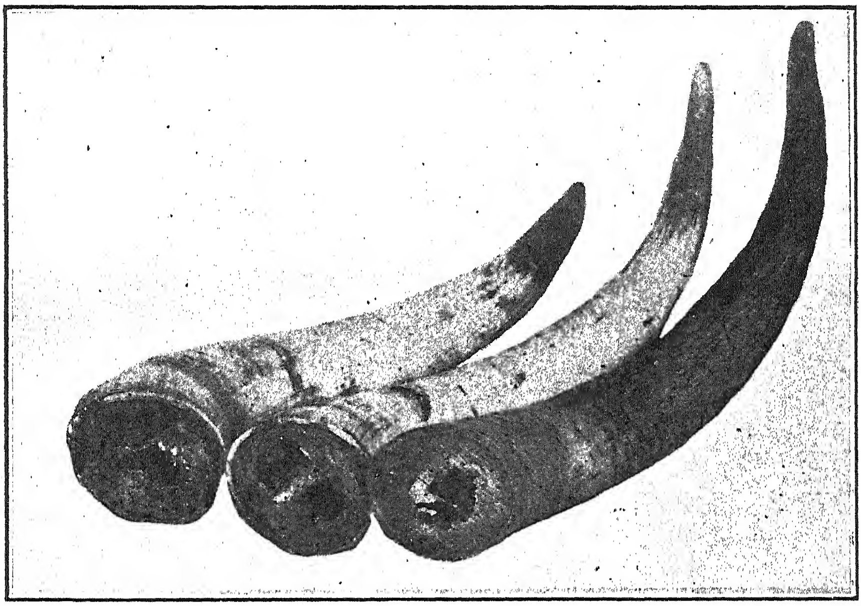


FIG. 1. HORNS SAWN OFF, SHOWING HOLLOWS.

The horn on left has been removed 3 in., that in middle 2 in., and the one on right, 1½ in. from the head.

" Forty head of polled cattle ; several slight hip and shoulder bruises, but nothing serious on the whole. Very clean, and no room for complaint."

" Sixteen horned bullocks ; seven carcases rather badly bruised."

THE HORN DESCRIBED.

Before dealing with the methods of dehorning, the horn itself may be described. Briefly, the horn is composed of two parts, the true horn or outer shell, which is of non-sensitive structure like the human finger-nails, and the core or inner structure, which is very vascular, and (unlike the quick underneath the human nail) is composed of open

bony structure richly supplied with blood-vessels, and hollow. It fits closely into the horn, and is a strong support to it, while the outer horn acts as its protection.

The growth of the horn does not start from the skull, but in tissue between it and the skin. At this period it is loose but for its connective tissue, blood-supply, and nerves, being then known as the bud or button, and can at this time be easily removed. As time goes on, the bud secures a firm hold upon the bones of the skull and absorbs that part of it which it covers, thereby opening up a direct communication between the frontal cavities of the head and subsequent cavities of the horn,

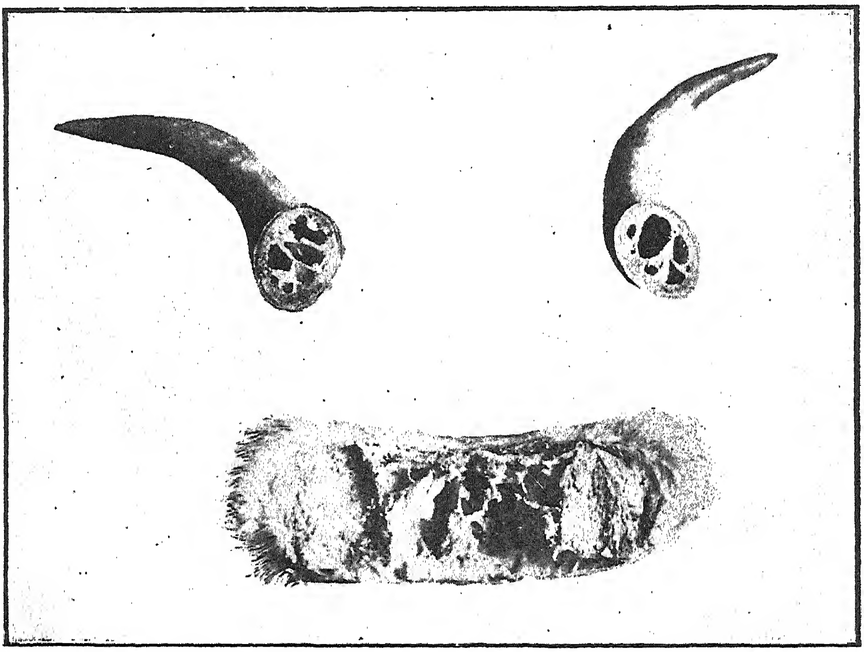


FIG. 2. HORNS REMOVED ½ IN. FROM THE HEAD, AND FRONTAL PART OF SKULL.
Showing sinuses (hollows) which interconnect skull and horns.

as shown in the accompanying illustrations. The horn is now to all intents and purposes a part of the skull, as will also be observed in the photos.

These sinuses are fairly large both in the horn and forehead. This offers, after the dehorning of adult cattle, facilities for the access of dirt into the head. If this is not guarded against suppuration may take place and be very troublesome. The presence of dirt or suppuration is shown by the animal shaking its head, holding it on one side, or rubbing the stump against some object. There is evidence of pain, and pus may make its appearance. In such cases it would be best to consult a veterinarian.

Thus horn-prevention in young calves is greatly to be preferred, for at that time there is no actual opening into the skull, and any dirt in the wound could be easily washed out.

HORN-PREVENTION IN YOUNG CALVES.

In calves, the undeveloped horn can be felt as a small round body loosely attached to the head just underneath the skin, and shaped like a button. The period to examine the calf for this is from the time it is a week old, as if there is to be a horn the sooner it is removed the better. If this stage is allowed to pass, and the horn shows through the skin, the operation should then be delayed for dehorning whenever the growth is sufficient for this purpose.

The best and most reliable method of horn-prevention is the surgical one, the only instrument generally employed being a sharp knife; but if the operator were to add to this equipment a pair of claw forceps and a pair of curved scissors the work could be more expeditiously done. The procedure is for an assistant to hold the calf in a steady position; the bud is then felt for, and the hair removed from the part sufficiently to leave a clear field for operation. With the forefinger and thumb the bud is raised until the skin is tense. A cut is then made with a sharp, clean knife over the centre of the bud; the claw foreceps are next used to pull the bud sufficiently far up to allow the curved scissors to get underneath and clip the bud out. No after-treatment is required, but if the weather is hot or the wound appears dirty a wash with a weak solution of any standard disinfectant should be given.

Another method is to clip the hair off, then wash the part with water, and when still wet apply caustic over all the bud. Caustic sticks can be procured from any chemist, and also a holder which will protect the operator's fingers. The only precautions necessary are that the whole of the bud, even its extreme edges, must be so treated, otherwise small horns may grow. Wet weather must be avoided, as this would weaken the caustic before its full effects took place. Only sufficient moisture is required to keep the end of the stick wet during the process of rubbing-in. One application is sufficient if properly done, and no after-treatment is required, but the animal should be again examined within a few days to see if the operation has been successful. If not, the scab should be removed by washing or brushing, and another application made.

DEHORNING OF ADULT CATTLE.

The best time to dehorn adult cattle is when the weather is cool and no blow-flies are about. Cows should be dehorned when the milking season is over or drawing to an end, and before they are many months in calf. When the animal is young and the horn green it is best to use a clean, sharp pair of shears. In older animals, and especially where the horns have a broad base, a sharp bone-saw should be used. This prevents any chance of fracturing the frontal bones of the head. This is common enough where the horn is very solid, especially if the shears are allowed to get blunt. In selecting a bone-saw one should be got

deep enough to go through a large horn without the back coming into contact with the horn, otherwise a clean-cut under-surface will not be attained.

When a number of cattle are to be dehorned, and by either method, it will be to the advantage of the operator to make special arrangements for holding the animals while being operated upon. An ordinary race can be used for this purpose, with certain alterations to the breast-bars—one to have a U-shaped notch in the centre, big enough to hold the windpipe and gullet. This prevents injury to these parts when the top bar, which is fixed upon a bolt at one end, is brought firmly down upon the upper part of the neck to keep the head steady. The cross-bars behind should be arranged to press firmly upon the hind quarters of the animal, so that it cannot move backwards even a few inches. This saves the fingers of the operator, and also his saw, from damage.

Having everything satisfactorily fixed up, grasp the horn with the left hand, and, after selecting the part where the dehorning is to take place, begin to saw quietly until a track has been made for the saw. There is no pain at this stage, as only the non-sensitive part of the horn is being gone into. Then drive quickly, but do not press the horn downwards more than just enough to relieve the saw, as a clean underneath cut is desirable. The other horn is now similarly treated, and the animal yarded for observation. Where only a bull is to be subjected to dehorning, this can be done by securely fixing him to a tree and using the saw in the same manner.

The correct distance from the head for taking off a horn is $1\frac{1}{2}$ in. If cut shorter than this a very large hole is left exposed on the head; if longer, the animal will still find a use for the stump as an offensive weapon.

The operation being finished, the yarded animals should be examined, and any case of excessive bleeding attended to by the application of tar. After-treatment is seldom required unless in hot weather, when, in all cases, tar should be applied to the stump. Where it is found that dirt has got into the head, causing suppuration, the cavity should be syringed out with water to which has been added some disinfectant.

CONCLUSION.

In milking-herds the result of the dehorning operation has been observed by the writer in some ten thousand cases. None of the animals died as a result, three slipped their calf, and a few delayed healing up. The milk-supply dropped on average 3 lb. the first day, regained 2 lb. the second day, and was back to normal the third day. There is no record of a subsequent additional quantity or quality of milk due to dehorning, only a general remark that the loss was more than made up, so that no definite information can be given upon this point.

The subject of the dehorning of cattle interests the meat trade, the stockowner, and the consumer, both from the standpoint of the prevention of cruelty and financially. It is claimed for dehorning (1) that a herd of cows settles down better after dehorning, thereby increasing the quantity and quality of the milk-yield to an appreciable

degree ; (2) that a large amount of bruising, especially in fat cattle forwarded for slaughter, can be avoided by the practice ; (3) that horned cattle inflict unnecessary cruelty upon each other ; and (4) that many fatalities to human beings would be prevented by dehorning.

THE SIX-HORSE-TEAM UNIT.

COST OF UPKEEP IN CANTERBURY.

E. J. FAWCETT, B.A. (Cantab.), Assistant Instructor in Agriculture, Christchurch.

THE necessity for research work in farm costing has been universally appreciated by agricultural economists, especially in America, and, to a lesser degree, in Great Britain. A new country with great natural resources is apt to ignore the importance of cost accountings, but, with the upward trend of the price of land, wages, and equipment, combined with the gradual exhaustion of virgin soil fertility, even the agriculturists of New Zealand are realizing that more attention must be given to the cost of production. It is often assumed that land-values are at present largely fictitious, but till this is proved by a correct balance-sheet the claim is futile.

In here discussing the cost of upkeep of the six-horse team in Canterbury it is realized that the figures submitted may be open to criticism. The idea of the investigation was not so much the establishment of a permanent basis on which the cost of cultural operations might be founded, but rather to suggest to farmers the immense importance to themselves of a complete and exhaustive inquiry into the costs of raising farm-produce. At the same time it does establish a basis on which the cost of cultural operations can be calculated, perhaps with greater accuracy than has hitherto been attempted in Canterbury.

SYSTEM OF THE INVESTIGATION.

In making this investigation the following questions were kept constantly in view : (1) The cost of maintaining a six-horse team for one year ; (2) the cost of cultural operations per acre, calculated at 150, 175, 200, 225, 250, and 275 working-days per annum.

Twenty-seven men were selected on land ranging from the downs at Waikari to the downs of Timaru, taking in the light plain country and also the better type of loam as found round Methven, Wakanui, and Lincoln. Good practical farmers were chosen in every instance. They were visited personally by the writer, and by dint of cross-examination the information as recorded was procured. Owing to the lack of records it was extremely difficult to procure absolutely reliable

data, in most cases estimates only being given. A questionnaire was prepared, an example of which is here printed, showing a typical estimate.

Specimen Copy of Questionnaire.

Farm No. 13. Name and Address:.........

Items of Cost.	Capital.			Interest.			Depreciation.			Repairs.			Annual Cost.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Horses	270	0	0	16	4	0	..			..			16	4	0
Replacement ..	..			..			36	0	0	..			36	0	0
Chaff (29 tons) ..	105	7	4	6	6	3	..			..			111	13	7
Oats (240 bushels) ..	34	0	0	2	0	8	..			..			36	0	8
Hay	..			..			..			..			..		
Grazing (15 acres) ..	225	0	0	12	18	0	11	5	0	..			24	3	0
Harness	65	0	0	3	18	0	2	0	0	3	15	0	8	13	0
Covers	15	0	0	0	18	0	7	10	0	..			8	8	0
Buildings ..	400	0	0	24	0	0	10	0	0	5	0	0	39	0	0
Insurance..	..			..			..			..			2	11	0
Shares	..			..			..			..			4	5	0
Shoeing	..			..			..			..			3	18	0
Machinery ..	460	0	0	27	12	0	38	0	0	25	0	0	90	12	0
Oil	..			..			..			..			3	0	0
Wages	..			..			..			..			94	0	0
Bonus	..			..			..			..			10	0	0
Keep (of teamster)	..			..			..			..			52	0	0
Totals ..	1,574	7	4	93	16	11	104	15	0	33	15	0	540	8	3

As experienced by investigators in other countries, the problem of a basis for valuation of horses and feed at once presented itself. The majority of the farmers interviewed expressed the opinion that feed (chaff, oats, and grazing) should be valued at the market price, and returns which might reasonably be expected from their use in other directions. On the average farm in Canterbury the final product is in the form of meat, wool, wheat, seeds, oats, or chaff. The team is maintained to enable the farmer to produce feed for his stock and to cultivate his land for his cash crops. In other words, he is not looking for a profit on his team, which is simply a means to an end, and therefore any feed used by that team must be charged at cost price and not market price. This principle has been laid down very rigidly by the Institute for Research in Agricultural Economics, at Oxford University. The Hon. C. S. Orwin, M.A., in his report on the Institute, points out that it is mainly the lack of farm records which drives the farmer to this basis of valuation. It is only by a sound system of farm accounts that a comparison can be made between the advisability of using crops as intermediate products (that is, crops fed to produce meat, wool, &c.), or putting them on the market, hoping to realize a larger margin of profit.

This question is one of great importance, but cannot be discussed at length here. So far as this article is concerned, it is sufficient to say that the feed consumed by horses is charged at cost price. Before it was possible to arrive at the cost of producing these feeds it was

necessary to set an arbitrary value on them, to enable the cost of horse labour expended on the oat crop to be calculated. For this purpose chaff was charged at £3 10s. per ton and oats at 2s. 6d. per bushel, which brought the cost of the team to £2 3s. 1d. per day on the basis of 250 days' work per year. The cost of cultural operations was then calculated, when it was found that, on the details supplied by the farmers concerned, chaff was costing £3 12s. 8d. per ton and oats 2s. 10d. per bushel. A correction was made accordingly in the cost of upkeep of the team. It is recognized that the figure thus obtained is not absolutely correct, but on the information available it is difficult to see what better method could be devised.

Horses are charged on valuation, as there is no information available to decide the cost of rearing an animal till such time as it becomes a useful part of the team.

Machinery and harness are charged on a new replacement value, a flat rate being used on all farms.

ANALYSIS OF COSTS (SEE ACCOMPANYING TABLES).

Table I is self-explanatory. All that need be said is that money invested in such things as horses, feed, land, harness, buildings, and machinery is charged at 6 per cent. interest. The annual expenditure on insurance, ploughshares, shoeing, oil, wages, bonus, and keep of teamster is not charged with interest. It is questionable whether this method is correct; but, as the payments are likely to be distributed over the whole year, the capital represented might be called "floating capital," and in this case at least is considered free of interest in order to simplify the estimate. In assessing the cost of grazing, the estimated cost of the establishment of the pasture (£2 5s.) is spread over three years, at the rate of 15s. per acre per annum.

It will be seen that the farm totals (Table I, column 19) are subject to a considerable "spread," or variation. By studying Tables I and II together the reasons for these variations are evident. The most obvious reasons for the spread in the estimates seem to be (1) soil variation, (2) farm location, (3) the efficiency of the teamster, and (4) amount of land cultivated.

In column 2 of Table II (horses) replacement covers both depreciation and deaths, amounting to 12 per cent. of the average capital value, which places the average life of a farm-horse at eight and a third working-years. This estimate opens up a subject requiring serious thought on the part of the farmer—namely, team-management. In the course of this inquiry several methods of maintaining the efficiency of the team came under notice, but the subject is beyond the scope of this article.

On farms 2 and 3 the practice is to feed straw-chaff and oats. It will be noted that in both cases the cost of feed is high—in fact, the estimates from farms 1, 2, and 3 are so high that they have rather a serious effect on the average cost of upkeep. In a later article, however, an attempt will be made to show the earning-capacity of the respective teams.

Table I, showing Annual Expenses under the Different Headings—i.e., *Interest on Invested Capital, Feed consumed, Current Expenses, Repairs, and Depreciation.*

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Farm No.	Horses (Interest, 6 %).	Horses (Replacement).	Chaff.	Oats.	Hay.	Grazing.	Harness.	Covers.	Buildings.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	18 0 0	30 0 0	84 14 3	203 12 2	10 12 0	28 7 0	12 8 0	7 8 0	56 0 0
2*	14 8 0	35 0 0	61 19 7	195 4 7	5 6 0	19 10 0	17 11 6	7 19 5	37 0 0
3*	14 8 0	30 0 0	28 12 2	225 4 2	..	36 19 0	8 18 0	8 18 0	49 10 0
4	14 8 0	35 0 0	142 9 4	54 16 0	15 18 0	27 0 0	13 18 0	13 0 0	29 0 0
5	19 16 0	20 0 0	134 15 1	72 12 9	..	32 0 8	11 10 0	8 14 9	21 0 0
6	16 4 0	35 0 0	138 12 7	26 5 5	..	24 15 0	14 18 0	10 11 4	26 0 0
7	18 0 0	30 0 0	138 12 7	45 0 7	5 6 0	33 15 0	13 18 0	6 0 1	30 8 0
8	18 0 0	30 0 0	138 12 9	24 14 7	..	37 16 0	10 18 0	5 18 0	19 0 0
9	14 8 0	30 0 0	154 1 0	26 4 7	..	27 6 0	16 8 0	6 14 5	22 10 0
10	14 8 0	30 0 0	123 5 1	43 10 6	11 13 2	25 10 0	13 18 0	8 8 0	26 5 0
11	18 0 0	30 0 0	115 10 8	60 1 1	..	27 6 0	11 3 0	6 14 4	30 0 0
12	13 4 0	40 0 0	134 15 8	32 8 5	..	24 16 8	24 18 0	7 7 10	20 2 0
13	16 4 0	36 0 0	111 13 7	36 0 8	..	24 3 0	8 13 0	8 8 0	39 0 0
14	18 0 0	25 0 0	96 5 3	37 10 8	..	32 15 0	13 12 0	8 4 4	23 16 0
15	14 8 0	40 0 0	96 5 3	30 0 7	25 0 0	25 12 4	6 0 0	10 1 4	33 0 0
16	14 8 0	27 10 0	146 6 11	..	..	31 10 0	11 18 0	5 18 0	31 0 0
17	16 4 0	32 6 0	115 10 8	6 0 1	5 6 0	38 5 0	13 6 0	6 14 4	22 0 0
18	14 8 0	30 0 0	115 10 8	14 11 5	..	25 10 0	11 18 0	6 14 5	20 0 0
19	16 4 0	45 0 0	111 13 9	14 8 3	..	37 10 0	12 4 0	5 17 7	27 0 0
20	14 8 0	30 0 0	131 15 8	..	..	27 6 0	10 18 0	9 1 5	17 10 0
21	12 12 0	31 10 0	115 4 8	18 0 4	..	25 10 0	13 18 0	6 3 3	22 0 0
22	14 8 0	30 0 0	115 10 8	..	..	25 10 0	11 1 0	6 14 5	23 15 0
23	16 4 0	38 0 0	111 13 7	..	..	19 10 0	10 0 0	9 2 6	29 0 0
24	14 8 0	18 0 0	138 12 7	..	..	36 3 4	8 8 0	5 17 7	28 19 0
25	12 12 0	22 10 0	127 1 8	..	..	25 10 0	8 18 0	8 8 0	10 7 0
26	13 8 8	25 0 0	96 4 3	7 10 0	2 12 11	34 13 0	11 0 0	7 18 11	20 10 0
27	12 12 0	25 0 0	115 10 0	..	..	33 16 8	11 5 0	5 17 7	27 0 0
Av.	15 6 5	30 15 5	116 16 4	58 13 10	8 2 0	29 4 8	12 7 0	7 14 8	27 9 4

1.	11.	12.	13.	14.	15.	16.	17.	18.	19.
Farm No.	Insurance.	Shares.	Shoes.	Machinery.	Oil.	Wages.	Bonus.	Keep of Teamster.	Total.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	4 9 3	0 15 0	6 18 0	85 0 0	6 0 0	150 0 0	..	52 0 0	762 4 5
2*	2 11 0	12 0 0	5 14 0	100 12 0	6 10 0	104 0 0	15 0 0	39 0 0	679 5 8
3*	2 11 0	4 5 0	3 12 0	93 2 0	6 10 0	104 0 0	10 0 0	52 0 0	678 9 4
4	2 11 0	12 0 0	..	109 12 0	5 0 0	104 0 0	10 0 0	52 0 0	640 12 10
5	1 5 6	7 0 0	8 8 0	76 17 0	2 12 0	130 0 0	15 0 0	78 0 0	639 11 9
6	1 18 3	7 0 0	12 0 0	117 12 0	3 0 0	130 0 0	..	52 0 0	615 16 7
7	2 4 7	6 6 0	3 18 0	77 12 0	5 0 0	104 0 0	10 0 0	52 0 0	582 0 10
8	1 18 3	3 12 0	7 4 0	80 12 0	3 10 0	104 0 0	17 10 0	78 0 0	581 5 7
9	1 11 8	11 5 0	7 4 0	75 12 0	3 0 0	119 0 0	..	52 0 0	567 4 8
10	2 11 0	3 5 0	3 15 0	82 12 0	4 0 0	104 0 8	10 0 0	52 0 0	559 0 9
11	1 18 3	6 0 0	..	78 12 0	4 16 0	102 0 0	10 0 0	52 0 0	554 1 4
12	1 5 4	11 5 0	5 0 0	61 12 0	2 0 0	120 0 0	..	52 0 0	550 14 11
13	2 11 0	4 5 0	3 18 0	90 12 0	3 0 0	94 0 0	10 0 0	52 0 0	540 8 3
14	1 15 0	4 10 0	..	102 12 0	5 4 0	104 0 0	10 0 0	52 0 0	536 4 3
15	1 18 3	10 10 0	6 12 0	85 12 0	7 15 0	104 0 0	10 0 0	52 0 0	533 17 9
16	1 18 3	1 0 0	..	77 12 0	2 5 0	104 0 0	14 0 0	52 0 0	521 6 2
17	1 5 6	7 10 0	..	62 12 0	2 16 0	104 0 0	10 0 0	65 0 0	508 15 7
18	0 19 0	9 0 0	15 0 0	70 12 0	3 0 0	104 0 0	10 0 0	52 0 0	503 3 6
19	1 11 8	2 14 0	..	50 19 0	2 8 0	114 0 0	..	52 0 0	493 10 3
20	0 19 1	6 0 0	..	69 12 0	4 10 0	104 0 0	10 0 0	52 0 0	491 0 0
21	1 5 4	3 12 0	..	72 12 0	2 0 0	114 0 0	..	52 0 0	490 7 7
22	1 5 4	1 2 6	3 15 0	72 12 0	3 5 0	114 0 0	..	52 0 0	474 18 11
23	1 18 4	2 2 0	..	58 2 0	2 0 0	104 0 0	14 0 0	52 0 0	467 12 5
24	1 2 4	6 15 0	..	67 12 0	3 0 0	97 10 0	..	39 0 0	465 7 10
25	0 12 9	3 0 0	..	73 12 0	2 5 0	104 0 0	10 0 0	52 0 0	460 16 5
26	1 5 6	5 0 0	..	64 12 0	3 15 0	104 0 0	10 0 0	52 0 0	459 10 3
27	1 11 8	0 9 0	..	56 0 0	1 6 0	104 0 0	..	52 0 0	446 7 5
Av.	1 16 1	5 17 2	6 12 9	78 6 4	3 14 3	109 4 1	11 8 4	53 8 11	548 5 8

* Horses fed on straw-chaff and oats.

Table II, showing Variation in Estimates of Items carrying Interest.

(For variations in hay, insurance, shoes, oil, wages, bonus, and keep, see Table I.)

2.		3.	4.	5.		6.		7.		8.			9.	
Horses.		Chaff.	Oats.	Grazing.		Harness (Capital Value, £65).		Covers.		Buildings.			Machinery. (Capital Value, £460.)	
Capital Value.	Replacement.			Area.	Capital Value.	Depreciation.	Repairs.	Capital Value.	Depreciation.	Capital Value.	Depreciation.	Repairs.	Depreciation.	Repairs.
£ s. d.	£ s. d.	Ton.	Bush.	Ac.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
300 0 0	30 0 0	22	1,356	9	360 0 0	2 5 0	6 5 0	13 10 0	6 15 0	700 0 0	10 0 0	4 0 0	32 8 0	25 0 0
240 0 0	35 0 0	*780	1,300	10	200 0 0	4 0 0	9 13 6	14 5 0	7 2 6	400 0 0	10 0 0	3 0 0	23 0 0	50 0 0
240 0 0	30 0 0	*360	1,500	16	416 0 0	1 0 0	4 0 0	15 0 0	8 0 0	400 0 0	18 0 0	7 10 0	15 10 0	50 0 0
240 0 0	35 0 0	37	365	12	300 0 0	3 0 0	7 0 0	16 16 0	12 0 0	400 0 0	4 0 0	1 0 0	32 0 0	50 0 0
330 0 0	20 0 0	35	484	12	384 0 0	3 2 0	4 10 0	15 12 0	7 16 0	200 0 0	8 0 0	1 0 0	27 5 0	22 0 0
270 0 0	35 0 0	36	175	15	225 0 0	5 0 0	6 0 0	18 18 0	9 9 0	300 0 0	5 0 0	3 0 0	66 0 0	24 0 0
300 0 0	30 0 0	36	300	15	375 0 0	3 5 0	6 15 0	13 10 0	5 4 0	350 0 0	7 0 0	2 8 0	23 0 0	27 0 0
300 0 0	30 0 0	36	153	12	480 0 0	2 10 0	4 10 0	15 0 0	5 0 0	300 0 0	1 0 0	..	28 0 0	25 0 0
240 0 0	30 0 0	40	180	10	330 0 0	7 10 0	5 0 0	12 0 0	6 0 0	250 0 0	7 10 0	..	23 0 0	25 0 0
240 0 0	30 0 0	32	290	10	300 0 0	2 0 0	8 0 0	15 0 0	7 10 0	250 0 0	6 5 0	5 0 0	30 0 0	25 0 0
300 0 0	30 0 0	30	400	10	330 0 0	2 5 0	5 0 0	12 0 0	6 0 0	300 0 0	9 0 0	3 0 0	31 0 0	20 0 0
220 0 0	40 0 0	35	216	12	264 0 0	13 10 0	7 10 0	13 4 0	6 12 0	200 0 0	6 2 0	2 0 0	23 10 0	10 10 0
270 0 0	36 0 0	29	240	15	225 0 0	2 0 0	3 15 0	15 0 0	7 10 0	400 0 0	10 0 0	5 0 0	38 0 0	25 0 0
300 0 0	25 0 0	25	250	15	375 0 0	3 7 0	6 7 0	12 0 0	7 10 0	280 0 0	5 0 0	2 0 0	25 0 0	50 0 0
240 0 0	40 0 0	25	200	14	252 0 0	2 5 0	5 0 0	18 0 0	9 0 0	300 0 0	10 0 0	5 0 0	28 0 0	30 0 0
240 0 0	27 0 0	38	..	10	400 0 0	3 10 0	4 10 0	15 0 0	5 0 0	300 0 0	12 0 0	1 0 0	30 0 0	20 0 0
270 0 0	32 6 0	30	40	15	450 0 0	4 8 0	5 0 0	12 0 0	6 0 0	200 0 0	8 0 0	2 0 0	20 0 0	15 0 0
240 0 0	30 0 0	30	100	10	300 0 0	3 0 0	5 0 0	12 0 0	6 0 0	150 0 0	5 0 0	6 0 0	23 0 0	20 0 0
270 0 0	45 0 0	29	96	10	500 0 0	3 6 0	5 0 0	10 10 0	5 5 0	250 0 0	10 0 0	2 0 0	15 7 0	8 0 0
240 0 0	30 0 0	35	..	10	330 0 0	3 10 0	3 10 0	16 4 0	8 2 0	150 0 0	7 10 0	1 0 0	20 0 0	22 0 0
210 0 0	31 10 0	30	120	10	300 0 0	4 0 0	6 0 0	11 0 0	5 10 0	200 0 0	8 0 0	2 0 0	23 0 0	22 0 0
240 0 0	30 0 0	30	..	10	300 0 0	3 18 0	3 5 0	12 0 0	6 0 0	200 0 0	6 15 0	5 0 0	23 0 0	22 0 0
270 0 0	38 0 0	29	..	10	200 0 0	3 0 0	3 2 0	16 6 0	8 3 0	300 0 0	10 0 0	1 0 0	22 0 0	8 10 0
240 0 0	18 0 0	36	..	18	317 14 0	1 10 0	3 0 0	15 0 0	4 19 7	325 0 0	9 0 0	1 9 0	20 0 0	20 0 0
210 0 0	22 10 0	33	..	12	300 0 0	1 0 0	4 0 0	15 0 0	7 10 0	100 0 0	3 7 0	1 0 0	36 0 0	10 0 0
228 0 0	25 0 0	25	50	11	400 0 0	3 7 0	3 15 0	14 4 0	7 2 0	200 0 0	7 0 0	1 10 0	22 0 0	15 0 0
210 0 0	25 0 0	30	..	8	464 0 0	3 7 0	4 0 0	10 10 0	5 5 0	250 0 0	10 0 0	2 0 0	18 8 0	10 0 0
255 9 7	30 15 0	31	391	12	337 13 10	3 10 2	5 3 3	14 1 1	6 17 1	283 10 4	7 18 1	2 13 10	26 12 2	24 2 3
ercentage of capital value	12	..	..	..	..	5·4	7·9	..	49	..	2·78	1·3	5·78	5·24

* Straw-chaff used; amount given in sacks.

Table III.—Summary of Expenses under the Different Headings.

1.	2.	3.	4.	5.	6.	7.	8.	9.
Farm No.	Estimated Capital invested.	Interest at 6 per Cent.	Depreciation (estimated by Farmers).	Repairs (estimated by Farmers).	Annual Charges under Columns 3, 4, and 5.	Cost of Feed (Cost Price).	Annual Floating Capital (Wages, Bonus, Keep, Oil, &c.).	Total Annual Charges.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	2,180 10 8	130 13 6	88 3 0	35 5 0	254 1 6	282 0 8	226 2 3	762 4 5
2	1,626 18 4	97 11 4	86 12 6	62 13 6	246 17 4	247 13 4	184 15 0	679 5 8
3	1,835 10 0	110 1 4	76 10 0	69 10 0	256 1 4	239 10 0	182 18 0	678 9 4
4	1,673 18 8	100 19 2	95 0 0	58 0 0	253 19 2	201 2 8	185 11 0	640 12 10
5	1,650 6 8	98 19 7	75 3 0	27 10 0	201 12 7	195 14 2	242 5 0	639 11 9
6	1,494 9 10	89 12 6	131 14 0	33 0 0	254 6 6	155 11 10	205 18 3	615 16 7
7	1,741 16 0	104 9 3	79 14 0	36 3 0	220 6 3	178 6 0	183 8 7	582 0 10
8	1,774 2 10	106 8 6	75 10 0	29 10 0	211 8 6	154 2 10	215 14 3	581 5 7
9	1,527 1 8	91 12 4	81 10 0	30 0 0	203 2 4	170 1 8	194 0 8	567 4 8
10	1,489 7 0	89 17 9	83 5 0	38 0 0	211 2 9	168 7 0	179 11 0	559 0 9
11	1,632 13 4	97 18 9	85 15 0	28 0 0	212 13 9	164 13 4	176 14 3	554 1 4
12	1,329 19 4	82 15 3	98 14 0	20 0 0	201 9 3	157 15 4	191 10 4	550 14 11
13	1,574 7 4	94 16 11	104 15 0	33 15 0	236 6 11	134 7 4	169 14 0	540 8 3
14	1,618 5 0	97 1 3	77 2 0	58 7 0	232 10 3	126 5 0	177 9 0	536 4 3
15	1,454 3 4	87 4 2	99 15 0	40 0 0	226 19 2	114 3 4	192 15 3	533 17 9
16	1,618 1 4	97 1 7	85 10 0	25 0 0	207 11 7	138 11 5	175 3 3	521 6 3
17	1,576 13 4	94 11 9	81 19 0	22 0 0	198 10 8	119 13 5	190 11 6	508 15 7
18	1,349 15 0	80 13 6	74 10 0	31 0 0	186 6 6	122 18 0	193 19 0	503 3 6
19	1,674 9 4	100 9 3	86 8 8	15 0 0	201 17 11	118 18 8	172 13 8	493 10 3
20	1,388 7 4	83 5 9	76 12 0	26 10 0	186 7 9	127 3 4	177 9 1	491 0 2
21	1,372 0 0	82 6 3	79 10 0	30 0 0	191 16 3	125 14 0	172 17 4	490 7 7
22	1,386 0 0	83 3 1	77 3 0	30 5 0	190 11 1	109 0 0	175 7 10	474 18 11
23	1,416 13 4	84 19 9	88 13 0	12 12 0	186 4 9	105 7 4	176 0 4	467 12 5
24	1,613 16 0	96 15 11	66 19 7	24 9 0	188 4 6	129 16 0	147 7 4	465 7 10
25	1,269 18 0	76 3 8	77 17 0	15 0 0	169 0 8	119 18 0	171 17 9	460 16 5
26	1,507 12 4	90 2 5	72 14 0	20 5 0	183 1 5	100 8 4	176 0 6	459 10 3
27	1,568 10 0	94 1 9	68 0 0	16 0 0	178 1 9	109 0 0	159 5 8	446 7 5
Averages	1,572 0 3	94 8 1	84 5 1	32 3 2	210 15 3	152 9 0	185 1 5	548 5 8

In the case of harness and of machinery a standard replacement value is taken—£65 for harness and £460 for machinery. It is interesting to note the percentage of repairs and depreciation to the capital value, as given in the bottom line (Table II).

Table III gives a summary of the expenses under the different headings. Column 2 ("Estimated Capital invested") includes the cost price of chaff, oats, and hay, the whole being charged with 6 per cent. interest. Column 7 gives cost of feed, grazing excluded. Cost of grazing has been charged in depreciation of pastures. Column 8 represents the bulk of the cash payments made during the year. To these amounts would be added repairs and some of the costs attached to the growing of oats for the following year.

As mentioned previously, the spread or variation in the final estimates is considerable. When taken together the yearly cost varies from £762 4s. 5d. on farm No. 1 to £446 7s. 5d. on farm No. 27. If this spread is expressed in points per cent., taking the average (£548 5s. 8d.) as 100, we find that the variation extends from 139 per cent. to 81 per cent., which equals plus 0·39 of the average to minus 0·19 of the average. This is expressed in Table IV.

Table IV, showing Total Annual Cost on all Farms.

Farm No.	Total Annual Cost. £ s. d.	Percentage Variation or "Spread."	Farm No.	Total Annual Cost. £ s. d.	Percentage Variation or "Spread."
1	762 4 5	139	15	533 17 9	97
2	679 5 8	124	16	521 6 2	95
3	678 9 4	124	17	508 15 7	93
4	640 12 10	117	18	503 3 6	92
5	639 11 9	116	19	493 10 3	90
6	615 16 7	112	20	491 0 2	89
7	582 0 10	106	21	490 7 7	89
8	581 5 7	106	22	474 18 11	87
9	567 4 8	103	23	467 12 5	85
10	559 0 9	102	24	465 7 10	84·75
11	554 11 4	101	25	460 16 5	84
12	550 14 11	100·5	26	459 10 3	83·5
13	540 8 3	98·5	27	446 7 5	81
14	536 4 3	98			

£548 5s. 8d. = 100 per cent. = average of twenty-seven farms.

The farms can be divided into three groups according to soil and locality—namely, medium loam, as found round such districts as Methven, Wakanui, and Lincoln; down land, as experienced round Timaru and in parts of North Canterbury; and light stony soils. Table V shows these groups with their respective variations worked out as in Table IV. The accompanying graph (printed on page 364) illustrates the same variation in a diagrammatic form.

Working off Table IV we can with reasonable accuracy assume that the cost of upkeep on a six-horse team is £548 5s. 8d. per year.

It is quite evident that a six-horse unit cannot be maintained throughout the year without an extra horse for relief work, and therefore, though with no ordinary implement will more than six horses be used, seven must be kept. On the estimates quoted, the extra horse will cost £44 4s. per year in interest, depreciation, feed, covers, and shoes. Where seven horses are kept this amount must be added, bringing the annual cost to £592 9s. 8d.

Table V, showing Classification of Farms into Soil-groups.

Farm No.	Total Annual Cost. £	s.	d.	Percentage Variation or "Spread."	
	Medium Loam.				
5	639	11	9	127	Average for group : £502 18s. 6d. = 100 per cent.
8	581	5	7	116	
16	521	6	2	104	
17	508	15	7	101	
19	493	10	3	98	
20	491	0	2	97·5	
21	490	7	7	97	
22	474	18	11	94	
23	467	12	5	93	
25	460	16	5	92	
26	459	10	3	91·75	
27	446	7	5	89	

Farm No.	Total Annual Cost. £	s.	d.	Percentage Variation or "Spread."	
	Downs Land.				
1	762	4	5	126	Average for group : £607 6s. 4d. = 100 per cent.
2	679	5	8	111	
3	678	9	4	111	
4	640	12	10	105	
6	615	16	7	101	
7	582	0	10	96	
10	559	0	9	92	
11	554	1	4	91	
14	536	4	3	88	
24	465	7	10	77	
	Light to Stony Land.				
9	567	4	8	105	Average for group : £540 6s. 6d. = 100 per cent.
12	550	14	11	102	
13	540	8	3	100	
15	533	17	9	99	
18	503	3	6	93	

The daily cost of the team, and correspondingly the cost of cultural operations, depends on the number of days the team is worked during the year. In Table VI the daily cost is shown for both six and seven horses working 150, 175, 200, 225, 250, or 275 days respectively.

Table VI, showing Cost of Team per Day (Eight Hours).

Number of Horses.	Number of Days worked. 150.			175.			200.			225.			250.			275.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
6 ..	3	13	1	3	2	8	2	14	10	2	8	6	2	3	10	1	19	10
7 ..	3	18	11	3	7	8	2	19	3	2	12	8	2	7	4	2	3	1

Taking the daily cost of six horses working 250 days in the year, t is interesting to note the distribution of the cost over the direct upkeep of the team, the expenses connected with the teamster, and the interest, depreciation, repairs, &c., of the harness, machinery, and buildings, as shown in Table VII. It must be remembered that the

cost of teamster (13s. 11d. per day) included keep and is only for 250 days in the year. Where the farmer is working the team himself he saves this direct charge.

Table VII, showing Distribution of Daily Cost of Team at £2 3s. 10d

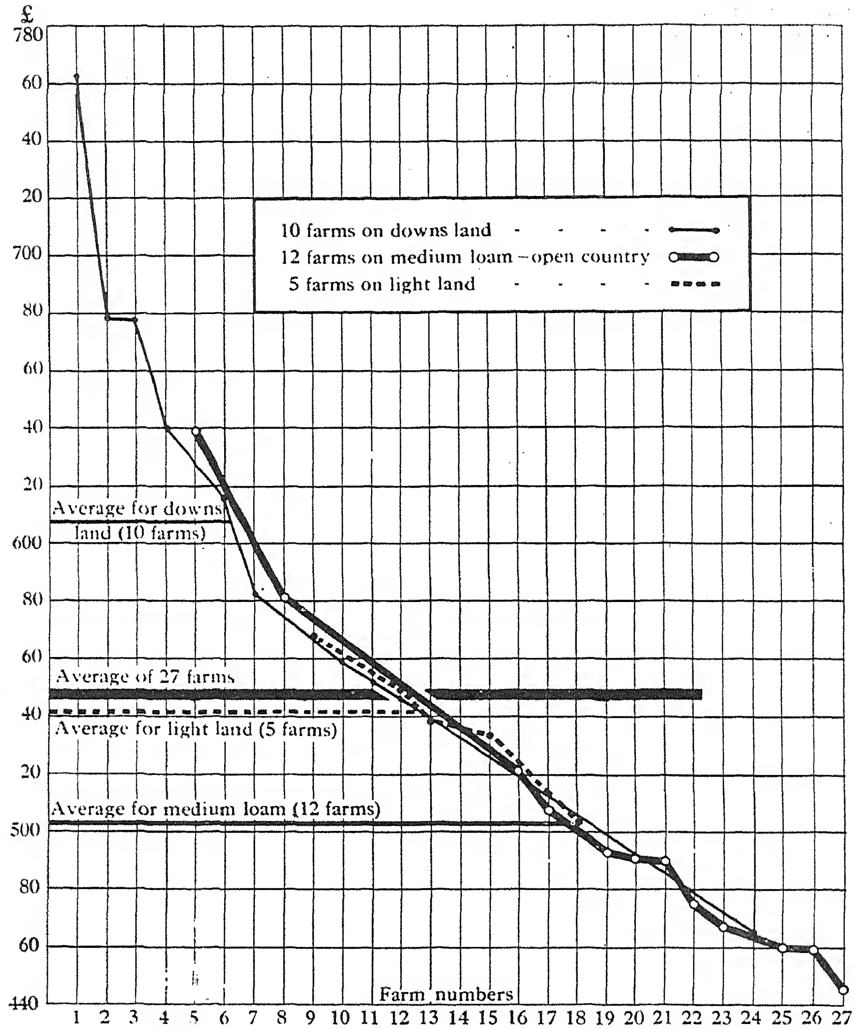
Item.	Cost.	Percentage of Total.
	£ s. d.	
Horses	1 1 0	47·909
Teamster	0 13 11	31·749
Interest, depreciation, repairs, &c. ..	0 8 11	20·342
Total	2 3 10	100·000

To determine the actual cost of cultural operations it was necessary to find the area worked per day with the respective implements. This information was collected from the same range of farmers. Column 1 of Table VIII shows the average of the twenty-seven estimates for the several operations, whereas column 3 shows the cost per acre over a wide range of working-days for both six and seven horses. In drilling and rolling, six horses will not be used. They must therefore be idle, or, if worked in any other way, an extra man will be required, which will balance the irregularity in the cost of these operations.

Table VIII, showing Cost of Tillage Operations per Acre.

1.		2.	3.											
Operations.	Acres per Day.	Number of Horses.	Number of Days worked.											
			150.		175.		200.		225.		250.		275.	
			s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Deep ploughing ..	4·64	6	15	9	13	6	11	10	10	8	9	5	8	7
		7	17	0	14	7	12	9	11	4	10	2	9	3
Skim-ploughing ..	5·13	6	14	3	12	3	10	8	9	5	8	6	7	9
		7	15	5	13	2	11	2	10	3	9	3	7	10
Disking ..	14·00	6	5	3	4	6	3	11	3	6	3	2	2	10
		7	5	8	4	10	4	3	3	8	3	5	3	1
Grubbing ..	13·20	6	5	6	4	9	4	2	3	8	3	4	3	0
		7	5	11	5	1	4	6	4	0	3	9	3	3
Heavy harrowing	28·40	6	2	7	2	2	1	11	1	8	1	7	1	5
		7	2	9	2	5	2	1	1	10	1	8	1	6
Light harrowing	30·50	6	2	5	2	0	1	10	1	6	1	5	1	4
		7	2	7	2	3	1	11	1	9	1	7	1	5
Drilling ..	14·00	6	5	4	4	6	3	11	3	6	3	2	2	10
		7	5	8	4	10	4	3	3	9	3	5	3	1
Rolling ..	17·77	6	4	1	3	6	3	1	2	9	2	6	2	3
		7	4	5	3	10	3	4	3	0	2	8	2	5

Graph showing Classification of Farms into Soil-groups.



SUMMARY.

It may reasonably be claimed that the average of the twenty-seven estimates given can be accepted as being as nearly correct as any estimate before submitted. It costs £548 5s. 8d. per year to keep six horses and equipment, or £592 9s. 8d. to keep seven horses and equipment. The cost varies on farms according to soils, locality, and management. The power unit is the most expensive item on the farm, and in many cases bad management of the team alone will cause a debit balance, when it should be bringing in an income for its owner. Every day the team is idle it costs the farmer somewhere in the vicinity of £2 without return. Unnecessary horses should not be kept on a farm, and those that are kept should be worked to full capacity.

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

VI. THE HAWKS AND OWLS.

J. G. MYERS, B.Sc., F.E.S., R.A.O.U., and ESMOND ATKINSON,
Biological Laboratory, Wellington.

REGARDING no other birds has enlightened opinion changed so much within the last few decades as in connection with the hawks and owls and their relation to agricultural interests. Had this article been written fifty years ago it would have consisted partly of invective, with perhaps a few philosophical reflections on the role of predaceous birds in a state of nature, and partly of specifications for traps and snares and other ways and means of decreasing the numbers of hawks and owls. Every man's hand was against them. The advance of science, with the increased respect paid to exact knowledge, gradually brought about a reconsideration of the position and an official exoneration of some of the species concerned. But it took years of teaching, in season and out of season, before even a few enlightened landowners ceased to look on the gibbeted carcases of kestrels and barn-owls as evidence of their gamekeepers' efficiency. Even yet we suppose it is by no means impossible to find the bodies of these entirely useful—almost incalculably useful—birds strung up in a mixed and unsavoury company of weasels, stoats, rats, cats, and other genuine vermin blighting a beautiful countryside with the odours of decay and the evidence of die-hard superstition. We speak, of course, of English conditions. In New Zealand, as a matter of course, the indigenous birds received by a kind of vicarious inheritance the benefit, or more frequently the blame, of the traditional beliefs regarding those English birds to which, in the popular mind, they were supposed to be the most nearly allied. If any comparison were made at all it was in favour of the birds of the homeland, from which an entirely injudicious selection was made for introduction into New Zealand.

It is an innate tendency of the human mind to seek explanations for all things—and, unfortunately, it is only of comparatively recent years that science has shown that just as much in the apparently familiar and trivial phenomena of the countryside as in superficially more serious issues the correct explanation is the only one to be desired. The cruel-looking talons and powerful beaks of the hawks and owls were taken as evidence enough that all such birds must live on a diet of flesh. In addition to the incriminating characters of bodily structure, shared with the hawks, the owls possess other qualities which did not tend to endear them to the popular imagination. In fact, their mysterious nocturnal habits, noiseless flight, and eerie cries rendered them objects of superstition, and were in themselves, as evidenced by the night-jar's case, sufficient to condemn them. The English night-jar or goat-sucker (*Caprimulgus europaeus*) is an entirely harmless, purely insectivorous bird, which pursues its prey, consisting largely of night-flying moths and beetles, when the falling dusk increases the ghostly appearance of its noiseless flight. Yet this bird is credited

with sucking the milk of goats and with other almost impossible misdemeanours entirely on account of its somewhat owl-like uncanny habits and appearance.

Misled by the similar characters of bill and feet, which are not due to true relationship, but more probably form an example of what is now known as "convergent evolution," similar environmental factors (in this case an identical method of procuring food) leading to resemblances often exact in structural details—misled, that is, by the great likeness in claws and beak between the hawks and owls—the earlier naturalist classed these two rather unrelated groups together as birds of prey (*Accipitres* or *Raptores*). Such an order, with two divisions—one for the hawks and eagles or diurnal birds of prey, and the other for the owls or nocturnal birds of prey—seemed a very natural grouping, but later research has shown that it was not justified. In any case, from an ecological and economic viewpoint it is necessary to draw a sharp line between the hawks and owls. Speaking generally, it may be said that although some of the hawks are purely beneficial and others predominatingly so, a number are entirely destructive; while all the owls are, on the whole, useful species. The distinction corresponds to the difference in habit; owls might be capable of taking chickens and game, but the time they choose for hunting is such that practically only noctural mammals and insects are likely to become their victims. We have, it is true, in New Zealand one owl, an introduced species, which is largely diurnal and bird-eating. Departing from our usual custom, we shall deal with it in this article along with the indigenous owls.

No consideration of the role of the diurnal birds of prey would be complete without a reference to the part played by otherwise purely destructive species when plagues of rodents, of small birds, or even of locusts are pursuing their course of devastation. Such irruptions act as foci on which concentrate predaceous birds from large areas. Moreover, in accordance with the principle to which reference has been made before, and which constitutes the first rule of economic ornithology, birds which normally live hardly at all on rats or mice or locusts, as the case may be, take the food which is thus spread before them in preference to their more usual but less easily captured prey. On these occasions the larger and more destructive of the hawk tribe may for a time be of very material service.

Gossard and Harry, writing of rats, rabbits, and injurious rodents generally, state: "They abound in forests, field, and orchards, and about the abodes of man, even seeking the shelter and protection of his roof and living upon the fruits of his labour. Probably through no means that human ingenuity is or will be able to devise can the scourge of noxious rodents be effectually checked. The raptors—the hawks and owls—constitute a natural, and probably the most important, check on the abnormal increase of these devastating animals. Plagues of rodents have been recorded from ancient times to the present day. At whatever time or place these have occurred investigation has disclosed that they followed a reduction in the numbers of the rapacious birds that normally ranged over the stricken areas. Nevada suffered such a plague during 1907–8, which resulted in great loss to the ranchman. Among the birds that flocked to the infested region to feed on

the animals were hawks, owls, gulls, crows, ravens, herons, and shrikes. Such food habits indicate not only an emergency value for these species, but with almost equal certainty prove their constant, though unrecognized worth. Thus, many of the hawks were shot by men who were trying to suppress the plague by means of poison. Just so long as the farmer destroys such valuable birds, just so long will his crops suffer through the ravages of destructive rodents and insects. Knowing the danger invited by the destruction of useful birds, the husbandman should demand their protection. A few species are in part or wholly detrimental, but it is the safer plan, where one does not know their specific value, to let the harmful live, rather than, through ignorance, to kill the beneficial."

None of the three New Zealand hawks can be ranked among the purely injurious species useful only on the rare occasions when the numbers of rats or other pests increase to the proportions of a plague.

The second category includes those species which are of mixed value, whose status must be independently determined in the different districts of their range. Thus they may be ranked justly as pure pests perhaps in a poultry or game-rearing locality, and as positive blessings in neighbouring rabbit-infested districts. The burning question—persecution or protection—is very liable to depend in these cases rather on the predominant interests than on an impartial investigation of the damage committed and the services rendered.

The third class comprises those kinds which are predominantly or entirely beneficial, and which should be strenuously protected wherever they occur. The European kestrel or windhover (*Cerchneis tinnunculus*) is an example, while the two indigenous owls of New Zealand should also be grouped here.

Coming now to the birds of New Zealand, we find the number of kinds of birds of prey rather surprisingly small. Such widespread groups as the vultures and eagles are totally unrepresented in the living avifauna, although it is true that the smaller moas often fell a victim to a gigantic, now extinct eagle—*Harpagornis*. The hawks are represented by two kinds of falcons, found nowhere else in the world, and by a harrier which occurs also in Australia. Two species of owls are indigenous and found nowhere else, while a third has been introduced to cope with the small-bird nuisance. These will all be now dealt with in turn.

THE BUSH-HAWK OR SPARROW-HAWK (NESIERAX POTTSI MATHEWS AND IREDALE).

This is the smaller of the two indigenous falcons, differing from the larger quail-hawk (*N. novaehollandiae* Gmelin) in very little else but size. Its upper plumage is a very dark brown, almost black, while the under-parts are reddish-brown marked with whitish. Both the bush-hawk and the quail-hawk are easily distinguished from the larger, gracefully gliding, and much more common harrier by their rapid dashing flight.

The nest may be placed in clumps of astelia in trees, or built on ledges of rock. The very handsome eggs are "yellowish-brown, stained and mottled with reddish-brown."

Although known as the bush-hawk, this species occurs also to a considerable extent in open country, where the rock-ledge type of nesting-site may be utilized. Guthrie-Smith considers that the bush-hawk has actually gained by the settlement of the country, the large numbers of introduced small birds proving a valuable addition to its food-supply. This little hawk appears nowhere to be common, although it may turn up in very unexpected places. Thus one of the writers saw a fine bird of this species sheltering in a macrocarpa cypress in the Wellington Botanical Gardens recently.

The bush-hawk is remarkable for its courage and rapacity, which enable it successfully to tackle birds much larger than itself. These fighting-qualities are much in evidence during the breeding season, when both sexes will not only drive away from the vicinity of the nest such large and powerful birds as the white heron and shag, but will unhesitatingly attack man himself; while they "have often chased cattle-dogs to the shelter of the stockman's horse."

Its food consists of rats, mice, lizards, and birds, and there can be little doubt that the predominating items are birds. There have been, and there possibly may be still, poultry-yards which suffer periodically from the attacks of bush-hawks. Fowls, ducks, and even young turkeys have been recorded as victims. On the whole, however, the bush-hawk is not plentiful enough to be a frequent pest in this respect, most of the depredations among poultry being the work of the far commoner harrier, which is the species most commonly intended when the term "hawk" is used. Far more often the introduced small birds become the prey of the bush-hawk.

The relation of the bush-hawk to the rabbit nuisance has not, so far as the writers are aware, been properly investigated. It is not even known whether this species preys to any extent on rabbits. Information on this point is eminently desirable.

To sum up, the bush-hawk may occasionally do considerable damage among poultry; it preys to a large extent on useful insectivorous or seed-distributing indigenous forest-birds, though the fact that it is itself indigenous renders its activities in this direction no disturbance of the balance of nature, and as such not to be viewed with apprehension, while, on the other hand, it accomplishes perennial good work in helping to abate the small-bird nuisance and in keeping down rats and mice. In its present limited numbers, then, the bush-hawk should not be considered a pest; but any untoward increase of the species would probably result in trouble to the poultry-keeper.

THE QUAIL-HAWK (NESIERAX NOVAEHOLLANDIAE GMELIN).

The quail-hawk is a considerably larger and more powerful bird than its congener, the preceding species. As, however, it differs in very little else besides size, doubts have frequently been expressed as to whether the two species are really distinct. An examination of the evidence inclines us to the view that there are two good species, but the question cannot be considered finally settled. Of the two the quail-hawk is very much the rarer—now so rare, in fact, that its economic relations are scarcely worth considering. Rats, mice, lizards, birds of many kinds, and even the larger beetles all figure in its

menu. It has a decided penchant for pigeons, both domestic and indigenous. This, coupled with its liking for poultry and its audacity in venturing even into houses in search of its prey, would render it a very serious foe to the poultry-keeper were its numbers at all great.

As a matter of fact, the only specimen of the quail-hawk of which the writers have heard at all recently was one observed by Mr. W. W. Smith, chasing sparrows almost in the Town of Wanganui.

The nest is usually placed in a rocky situation, and the breeding-habits are believed to resemble closely those of its near ally the bush-hawk.

THE HARRIER (CIRCUS APPROXIMANS PEALE).

The harrier is the largest and commonest bird of prey inhabiting New Zealand. Its lazily gliding form is a familiar feature of the rural landscape from the North Cape to the Bluff. It occurs also in Australia.

Harriers generally, the world over, form a well-defined group of raptorial birds, with long tails and legs, and a habit of leisurely quartering the ground with easy and graceful flight "accomplished with no apparent effort." The nest is usually placed on the ground, though one of the writers has found several nests of the New Zealand harrier, near Wanganui, placed 20 ft. or 30 ft. above the ground in low trees, tangled masses of supplejack, &c. The eggs are white—more like those of owls than the richly marked eggs of the true hawks. From the latter the harriers differ also in their less courageous disposition and in the correspondingly more defenceless nature of their usual victims. These qualities, coupled with the habit of feeding on carrion and offal, while they render the harriers generally and the New Zealand one in particular very unpopular with bird-lovers, frequently make them valuable from an economic point of view. Thus Gossard and Harry write, regarding the common North American species (*Circus pudsonius* Linn.): "The character of its food makes it one of the most valuable among the birds of prey . . . protection should be afforded this worthy species." Such an unqualified eulogy cannot be delivered on the New Zealand harrier; but there can be no question whatever that its unsavoury reputation is by no means all deserved, while its many good qualities are persistently overlooked.

The food of the harrier consists not only of carrion, offal, and of such birds—sick or wounded or small—as it can safely attack, and mice, rats, lizards, and frogs, but also of all insects large enough to excite its appetite. From a consideration of the food of other harriers throughout the world, from observation in the field on the New Zealand species, and from an examination of the stomach-contents of several specimens, the present writers are strongly inclined to the opinion that birds form a much smaller percentage of the food than is usually imagined. It is true that Buller records the finding of remains of no fewer than eleven pheasants, five rats, three quail, and one weka (*Gallivallus* sp.) round a harrier's nest containing young birds, while A. H. Messenger in a recent number of the *New Zealand Life and Forest Magazine*, writing on the enemies of a North Auckland game-farm, files a very serious indictment of the harrier. The latter

observer states that the harrier "takes a heavy toll of pheasant chicks and even full-grown birds. . . . In one of the paddocks on the game-farm . . . about a hundred young pheasants were turned loose. These birds were about three-parts grown and able to shift for themselves, yet every time one of them came out from cover to search for food a hawk would swoop down in an attempt to capture it. All day long these hawks were hovering overhead, and only the constant watchfulness of the keeper saved the pheasant flock from serious losses. Mr. Dobson (the keeper in question) states that on one occasion he took a hen pheasant and placed it out in an open paddock under a wire cage. Lying hidden in some scrub near-by, he shot fifteen hawks in three hours, as these hungry marauders came swooping down on their apparently defenceless victim."

These two items seem to indicate that harriers in the neighbourhood of game-farms are to be condemned in no uncertain manner. On the other hand, when one considers the extreme abundance of harriers throughout the country, and the very great infrequency with which one hears reports of damage by harriers in poultry-yards, one is forced to conclude either that the young birds of the game-rearing establishment form an easier and exceptionally enticing prey, or that domestic and semi-domestic birds are not as a general rule attacked. As a matter of fact, the harrier is known to be very timid; it has been put to flight by starlings, Australian magpies, and domestic fowls, while guinea-fowls are said to be such efficient guards against hawks that they are often kept on North Auckland farms as a protection for the other poultry with which they feed.

The stomachs of several harriers shot in the North Auckland district in March contained the remains of a rat, of large black crickets (*Gryllus servillei*), and of the migratory or true locust (*Locusta migratoria*). Of these animals the first two are, of course, serious pests, while the locust is a potential one, kept in bounds by natural means, of which bird enemies—in this case chiefly kingfishers (see article of this series in October *Journal*) and harriers—are probably very important. As regards rats, Buller records that a thousand harriers were shot per year on a Canterbury station for three years, and at the end of that period rats had become extremely numerous. In rabbit-infested districts it is generally recognized that harriers are beneficial.

One of the most serious crimes laid at the door of the harrier is the killing of young or sickly lambs. There is no innate impossibility in this, it is true; the writers have repeatedly seen that the carcases of recently dead lambs have had their eyes picked out, apparently by the harrier hawks, which eventually reduce the bodies to skeletons. At the same time no exact proof has ever been brought forward of the actual killing of lambs by harriers. Buller makes the rather cautious statement that they "are said to be very destructive during the lambing season."

In summarizing the evidence for the economic position of the harrier we should mention, firstly, that these facts are proved—namely, that the harrier renders extremely valuable services in the destruction of rats, mice, and the larger insect pests such as crickets and locusts, of which, by reason of its large size, voracious appetite,

and most assiduous hunting, it must capture incalculable numbers; while, on the other hand, it is admittedly a very serious pest of game-rearing establishments. With regard to lambs, whether the harrier actually kills young healthy lambs or whether it attends only to sick, dying, or dead ones remains to be proved by exact observation. More information is also required as to its value as a destroyer of rabbits. Accurate data are essential; only on the acquirement of these can the treatment to be meted out to harriers in the different districts be *profitably* decided. In a district containing no game-rearing establishments and no extensive sheep-farms it is obviously not only waste of money but sheer foolishness to put a price on the head of the harrier. In the immediate vicinity of game-farms hawks may be kept down by all possible means.

THE LAUGHING-OWL (SCELOGLAUX ALBIFACIES GRAY).

As this fine endemic species is now extremely rare, if not entirely extinct, it may be here dismissed in a very few words. It fed largely on the Maori rat (*Mus exulans* Peale) and on the larger beetles. It has been the fashion to attribute its decrease to the practical extinction of the Maori rat, but as this animal was almost certainly brought to New Zealand by human agency it could not have formed the primitive food-supply of the laughing-owl.

THE MOREPORK (SPILOGLAUX NOVAESEELANDIAE GMELIN).

Every one knows the morepork, or ruru—at least by its note. It is a small brownish owl, common in many parts of the Dominion, even in the immediate neighbourhood of cities. The roundish pure-white eggs are laid in a hole in a tree, or even in masses of needles in the forks of pine-trees. The old birds will often attack persons in the vicinity of the nesting-site.

The morepork is almost solely nocturnal, sallying forth at dusk to search with noiseless flight for mice, rats, and for various insects, which latter it sometimes takes on the wing.

Among the insects destroyed by this wholly useful bird are beetles, many of them the mature stages of destructive borers, including the most injurious of our larger timber-grubs—the huhu (*Prionoplus recticularis*), the large weevil (*Rhyncodes ursus*), and various species of wetas. On several occasions an entomological friend of the writers, who collected the moths attracted by a certain street-lamp, found a morepork in attendance, playing havoc with his prospective specimens. When it is remembered that the larvæ of a large proportion of these moths are injurious caterpillars, including cutworms and army-worms, it will be agreed that the insectivorous propensities of the morepork should ensure it a high place in the good graces of the agriculturist.

It may be regarded as certain that the morepork subsists almost entirely on rats, mice, and insects, but, as Buller states, of the fact that it "also preys on small birds there can be no reasonable doubt, although it has been frequently denied." Not only has it been known to take some of the smaller bush-birds such as bell-birds and king-fishers (Buller), but cage-birds also have fallen victims. The very infrequency of such cases, however, coupled with the abundance of

FIG. 1. YOUNG MOREPORK, A FEW WEEKS OLD.

Of two eggs in the nest only one was hatched. The young bird was photographed after temporary removal to the base of a neighbouring tree.

[*Photo by F. Bruce Levy.*

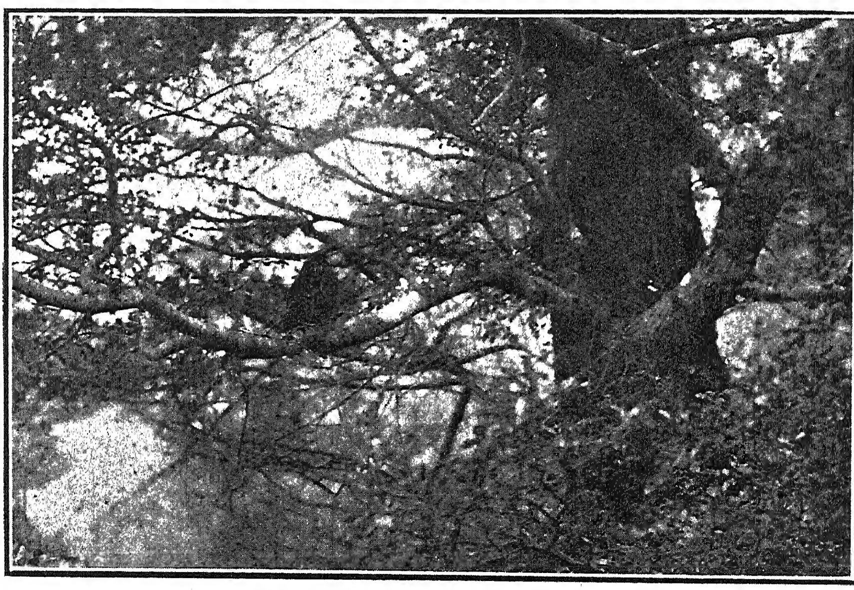


FIG. 2. SHOWING THE MOTHER MOREPORK.

The bird perched on a branch is watching the search operations at her nest in another beech-tree a few yards away. Bush at York Bay, near Wellington.

[*Photo by W. D. Reid.*

moreporks, even around dwellings, indicates that such lapses are entirely exceptional. Oliver states that a report was received of the destruction of indigenous small-birds by moreporks on Little Barrier Island, but an examination of the stomach-contents of six disclosed nothing but the remains of insects, chiefly the large and injurious chafer (*Stethaspis suturalis*).

The morepork deserves all possible protection. It is gratifying to see that already in many quarters its value is fully recognized.

THE INTRODUCED LITTLE OWL (ATHENE NOCTUA SCOP.).

This small owl is indigenous to Europe. In 1906–8 it was introduced into Otago to cope with the small-bird nuisance. In this case, as with the morepork, it was not realized that the diet is very largely insectivorous. In fact, it seems a truth singularly difficult of comprehension by the popular mind that even large and powerful "birds of prey" are often considerably addicted to insect food. But the little owl is chiefly a daylight hunter, and although beetles and other insects form a large part of its food it is certainly true that it destroys far more birds than does the morepork.

Mr. H. C. Anderson, of Stirling, in a very informative letter written this year to one of the writers, draws attention to the fact that the covered nests of the sparrows are much less likely to be robbed of young birds by the little owl than are the open nests of less injurious species. In fact, it has been rumoured that the little owl was likely to inflict far more damage on the indigenous birds than on the introduced ones it was imported to control. Nor would such a case be without precedent in the disastrous annals of "acclimatization." There seems at present, however, little need for apprehension on this score. Philpott (quoted by Thomson) states that "observations have shown that the little owl does not enter the bush, but keeps on the outskirts or about isolated trees. For this reason I do not anticipate that our native bush-birds stand in much danger from this owl." The same writer in 1918 considered, "There can be no doubt that such introduced birds as the sparrow and others which roost about hedges, plantations, and buildings will pay a heavy toll; indeed, I have reason to think that the thrush, the sparrow, and the starling are already diminishing in numbers near Invercargill. Where a pair of owls have established themselves the evensong of the thrushes and blackbirds gives place to an incessant chorus of terrified alarm-notes."

Mr. Anderson, in the letter above referred to, deplores the fact that starlings, thrushes, and blackbirds were fast disappearing owing to the attacks of the little owl, while sparrows seemed as numerous as ever. He further states that "in the last few years the grass-grub has taken a big hold in pastures in south Otago, and its presence is largely responsible for comment on the absence of the starling, thrush, and blackbird."

CONCLUSION.

In concluding this article on the hawks and owls the writers feel that the need for exact information is greater than their present data can fill. Their object will, however, be attained if they have succeeded in showing, firstly, that hawks and owls do indubitably render very

valuable services in the destruction of vermin and insect-pests, and, secondly, that there is a crying need for careful observation to decide the status of every particular species in every particular district.

REFERENCES.

BULLER, W. L. (1887): A History of the Birds of New Zealand, 2nd ed.
GOSSARD AND HARRY (1912): Some Ohio Birds, *Bull. 250, Ohio, Agric. Expt. Station*, Wooster.
M'LEAN, J. C. (1911): Bush-birds of New Zealand. *Emu*, vol. 11.
MESSENGER, A. H. (1923): Enemies of the Game-farm. *N.Z. Life and Forest Magazine*, No. 12, pp. 11–12.
OLIVER, W. R. B. (1922): The Birds of Little Barrier Island, New Zealand. *Emu*, vol. 22, pp. 45–51.
THOMSON, G. M. (1922): The Naturalization of Animals and Plants in New Zealand.

THE OVERRUN IN BUTTERMAKING.

G. M. VALENTINE, Dairy Instructor, Auckland.

THE clause in the Dairy Industry Amendment Act, passed in 1922, requiring manufacturers of butter and cheese to furnish to every milk or cream supplier each year a statement showing the amount of butter and cheese made from each pound of fat received has led to an increased interest in the subject, and the question is frequently asked, What is the overrun? Overrun is usually spoken of as the amount of butter made in excess of the butterfat received. Owing to losses in manufacture, however, and to the allowance of overweight in each box of butter sold, in actual practice it is the amount of butter for which payment is received in excess of the butterfat paid for.

Overrun is made up of the water, salt, and curd which butter contains in addition to butterfat, which is the principal ingredient. It is usually shown as the percentage of butter in excess of the fat received, but may be shown as the ratio of fat to butter made. For example, if we pay for 100 lb. of fat and sell 120 lb. of butter the overrun is 20 per cent., but the ratio of fat received to butter made would be 1 to 1·20.

Overrun in buttermaking and yield in cheesemaking are the same, but in cheesemaking it is expressed as yield, as, for instance, pounds of cheese made per pounds of fat received = 2·6.

The pfercentage of overrun is calculated as follows: Butter made — fat received × 100 ÷ fat received = per cent. of overrun. For example —Butter sold, 240 lb.: butterfat paid for, 200 lb.: 240 — 200 = 40 lb. overrun: 40 × 100 ÷ 200 = 20 per cent. overrun.

The factors which influence the amount of overrun are: (1) Actual losses of fat in manufacturing; (2) deficiency of matter not fat contained in the finished butter; and (3) errors in calculating the amount of fat received.

ACTUAL LOSSES OF FAT.

Two systems of butter-manufacture are in operation under factory conditions—namely, (1) butter made from whole milk received, and (2) butter made from cream received; and these two systems are

generally spoken of as "whole milk" and "home separation." A few factory concerns operate both systems.

The actual loss of fat under the whole-milk system averages probably 3·25 per cent. of the fat received in the milk; and under the home-separation system 1·75 per cent. of the fat received in the cream. Under the whole-milk system the actual losses of fat may be classified under four heads: (1) Loss in skimming milk; (2) loss in handling cream and butter; (3) loss in buttermilk; and (4) loss in packing butter. In the home-separation system the actual losses come under the last three heads.

The percentage of fat lost in skim-milk and in buttermilk can be ascertained by means of the butyl alcohol Babcock test. This test gives results corresponding closely to results obtained by gravimetric analysis, and shows higher and more correct results than are readable in the ordinary Babcock test. The test is, briefly, 2 c.c. of normal butyl alcohol, 9 c.c. of milk, and 7 to 9 c.c. of 182–183 sp. gr. sulphuric acid, placed in a 0·5 graduated bottle, whirled 6–2–2 minutes, and the reading doubled.

Skim-milk is generally about 85 per cent. to 90 per cent. of the whole milk, and contains an average of about 0·07 per cent. of fat when milk containing 4 per cent. of fat is separated. The loss of fat from that received in the milk is approximately 1·5 per cent. Thus 90 lb. skim-milk contain $0{\cdot}07 \times 90 \div 100 = 0{\cdot}063$ lb. fat. From 4 lb. fat in milk the loss is 0·063 lb. From 100 lb. fat in milk the loss is $0{\cdot}063 \div 4 \times 100 = 1{\cdot}57$ per cent. The loss of fat in handling cream from the separator to the pasteurizer, in running it to the churn and in the handling of the resultant butter exclusive of the loss in buttermilk, and in packing or pounding the butter, is difficult to estimate, but can reasonably be set down at 0·5 per cent. of the fat received.

The amount of buttermilk from cream containing 40 per cent. of fat, including an allowance for water used in handling and churning, may be stated at about 65 lb. per 100 lb., and a normal percentage of fat in the resultant buttermilk is about 0·5 per cent. This loss of fat from that received in cream is equal to 0·81 per cent., thus: $65 \times 0{\cdot}5 \div 100 = 0{\cdot}325$ lb. fat lost from 40 lb. fat in cream. The loss per 100 lb. of fat would be $0{\cdot}325 \div 40 \times 100 = 0{\cdot}81$ per cent.

Boxes of bulk butter usually contain 56 lb. 8 oz. of butter, including the weight of the wrapping-paper, which, when taken off, weighs about 4 oz. It is customary to place 4 oz. of butter in each box and make no charge for it, to allow for possible shrinkage and other wastage. A similar allowance is sometimes made for unavoidable losses incurred in pounding up each 56 lb. of butter for local trade. With butter containing 82·5 per cent. of fat the loss is 0·444 per cent. of the fat contained in the butter. Thus 56·25 lb. butter contains 46·40625 lb. fat, since $56{\cdot}25 \times 82{\cdot}5 \div 100 = 46{\cdot}40625$; 0·25 lb. butter contains 0·20625 lb. fat, since $0{\cdot}25 \times 82{\cdot}5 \div 100 = 0{\cdot}20625$; 0·20625 lb. fat in 46·40625 lb. fat = 0·444 per cent., as $0{\cdot}20625 \times 100 \div 46{\cdot}40625 = 0{\cdot}444$ per cent.

It is recognized that some of the losses have in practice occurred before that stage of manufacture has arrived for which later losses have been calculated. The variations thus caused are, however, of

no practical significance for our purpose, as they affect only the second place of decimals.

In each system the actual losses of the fat received are therefore approximately as follows :—

Under Whole Milk.

	Per Cent.
Skim-milk	1·5
Handling cream and butter ..	0·5
Buttermilk	0·81
Packing butter	0·444
Total	3·254

Under Home Separation.

	Per Cent.
Handling cream and butter ..	0·5
Buttermilk	0·81
Packing butter	0·444
Total	1·754

The constituents of butter are generally noted in short analysis under four heads as (1) fat, (2) water, (3) salt, (4) curd and ash. New Zealand butter of average quality contains about 82·5 per cent. fat, 15 per cent. water, 1·5 per cent. salt, and 1 per cent. curd and ash.

The overrun under the whole-milk system, when butter of such composition is made and the loss of fat is 3·25 per cent. of the fat received in the milk, will be 17·25 per cent. Thus, $100 - 3·25 =$ 96·75 lb. fat sold in butter ; $96·75 \times 100 \div 82·5 = 117·25$ lb. butter made per 100 lb. fat purchased in milk, giving an overrun of 17·25 per cent.

Under the home-separation system, and when the loss of fat is 1·75 per cent. of the fat received in the cream, the overrun will be 19·09 per cent. Thus, $100 - 1·75 = 98·25$ lb. fat sold in butter ; $98·25 \times 100 \div 82·5 = 119·09$ lb. butter made from 100 lb. fat purchased in cream, giving an overrun of 19·09 per cent.

If it were possible to manufacture fat into butter without loss it would therefore be possible to make an overrun of 25 per cent. Since 80 lb. fat — the legal minimum percentage — would represent 100 lb. butter, 100 lb. fat would represent 125 lb. butter, or an overrun of 25 per cent. But as manufacturing losses do occur, if we assume these to be as indicated above, the overrun will be as follows :—

Under whole milk : 100 lb. fat received, less 3·25 lb. lost, equals 96·75 lb. fat retained in butter sold. If 80 lb. of fat represent 100 lb. of butter, 96·75 lb. of fat would represent $96·75 \times 100 \div 80 = 120·93$ lb. butter, or an overrun of 20·93 per cent.

Under home separation : 100 lb. fat received, less 1·75 lb. lost, equals 98·25 lb. fat retained in the butter sold. If 80 lb. fat represent 100 lb. butter, 98·25 lb. fat would represent $98·25 \times 100 \div 80 = 122·80$ lb. butter, or an overrun of 22·80 per cent. As the fat content of butter is not infrequently as high as 85 per cent., however, and as a fat content of 80 per cent. is seldom found, an average of 82·5 per cent. may be taken as fairly general.

DEFICIENCY IN MATTER NOT FAT.

The amount of matter not fat which butter may contain is limited by legal enactment, which requires that butter shall contain not less than 80 per cent. of milk (butter) fat and not more than 16 per cent. of water. The manufacture of unsalted butter, which has a high fat content, will reduce the overrun, while if butter be made for the

American market, which requires about 3 per cent. of salt, the fat content will be lower and the overrun higher. When making for the British market, which requires about 2 per cent. of salt, it can be regarded as good work if butter is made containing: fat, 81·5 per cent.; water, 15·5 per cent.; salt, 2 per cent.; and curd, 1 per cent. The overrun if this average is maintained would therefore be—whole milk, 18·71 per cent.; home separation, 20·55 per cent.

A careful check can be kept on the various constituents of the butter made, by means of the several tests with which all buttermakers are familiar, provided a representative sample of the butter in the churn is obtained. To do so it is necessary to take small pieces of butter from different parts of the churn and emulsify and thoroughly mix them. Tests may be made from the same sample in the following order: Moisture, by the drying-off method; fat, by the benzine process; salt, by the silver nitrate test; and curd and ash, by subtracting the total of the first three from one hundred.

The accompanying table shows the overrun obtainable under varying conditions, and gives an indication whether the losses under either of these headings have been excessive, providing all and only the butterfat received has been paid for. It will be noted that when the butter made contains 82·5 per cent. of fat, the loss of ¼ per cent. of fat in manufacturing reduces the overrun approximately 0·3 per cent. The loss of ¼ per cent. in matter not fat, such as a low water content, reduces the overrun 0·36 per cent. approximately. The aim of the buttermaker will be, then, to retain as much of the water in the finished butter as the legal standard will allow, and the maximum amount of salt, having due regard to the taste of the buyer, since any deficiency in either must be made up with butterfat and the overrun be thereby reduced.

ERRORS IN CALCULATING THE AMOUNT OF FAT RECEIVED.

Under the whole-milk system errors in calculating the amount of fat are not so likely to occur as when handling cream, since the former is weighed in larger quantities, is more liquid and therefore more easily sampled, and the testing is a simpler process. With cream, which is in smaller quantities and contains a higher content of butterfat, the same accuracy is not possible. The tare weights on cream-cans should be marked to half-pounds, and if not exact should be made so by the addition of solder to the bottom of the can. Net weight to ½ lb. should be credited to the supplier, and even then the fractional weights which cannot be credited will give the factory an advantage at this stage.

Sampling, on the other hand, and all other parts of the testing will incline to give the supplier the advantage, with the exception of fractions in reading the test, and the practice of some factories in crediting to ½ per cent. is undoubtedly more accurate. Since these are matters of calculation, the term "loss" under this heading is hardly correct, as no butterfat is actually lost. Want of attention to these details, however, will have a considerable influence on the overrun and consequently on the payments for butterfat. A sample of cream which contains 40 per cent. of fat, if credited to the supplier

TABLE SHOWING THE OVERRUN OBTAINABLE UNDER VARYING CONDITIONS.

Composition of Butter.		Percentage of Manufacturing Losses.														
Fat Per Cent.	Matter Not Fat Per Cent.	0	0·25	0.50	0·75	1·0	1·25	1·5	1·75	2·0	2·25	2·5	2·75	3·0	3·25	3·5
		Percentage of Overrun.														
80·00	20·00	25·00	24·68	24·37	24·06	23·75	23·43	23·12	22·81	22·50	22·18	21·87	21·56	21·25	20·93	20·62
80·25	19·75	24·61	24·29	23·98	23·67	23·36	23·05	22·74	22·42	22·11	21·80	21·49	21·18	20·87	20·56	20·24
80·50	19·50	24·22	23·91	23·60	23·29	22·98	22·67	22·36	22·04	21·73	21·42	21·11	20·80	20·49	20·18	19·87
80·75	19·25	23·83	23·52	23·21	22·91	22·60	22·29	21·98	21·67	21·36	21·05	20·74	20·43	20·12	19·81	19·50
81·00	19·00	23·45	23·14	22·83	22·53	22·22	21·91	21·60	21·29	20·98	20·67	20·37	20·06	19·75	19·44	19·13
81·25	18·75	23·07	22·76	22·46	22·15	21·84	21·53	21·23	20·92	20·61	20·30	20·00	19·69	19·38	19·07	18·76
81·50	18·50	22·69	22·39	22·08	21·77	21·47	21·16	20·85	20·55	20·24	19·93	19·63	19·32	19·01	18·71	18·40
81·75	18·25	22·32	22·01	21·71	21·40	21·10	20·78	20·48	20·18	19·87	19·57	19·26	18·96	18·65	18·34	18·04
82·00	18·00	21·95	21·64	21·34	21·03	20·73	20·42	20·12	19·81	19·50	19·20	18·90	18·59	18·29	17·98	17·68
82·25	17·75	21·58	21·27	20·97	20·66	20·36	20·06	19·75	19·45	19·14	18·84	18·54	18·23	17·93	17·62	17·32
82·50	17·50	21·21	20·90	20·60	20·30	20·00	19·69	19·39	19·09	18·78	18·48	18·18	17·87	17·57	17·27	16·96
82·75	17·25	20·84	20·54	20·24	19·93	19·63	19·33	19·03	18·73	18·42	18·12	17·82	17·52	17·22	16·91	16·61
83·00	17·00	20·48	20·18	19·67	19·57	19·27	18·97	18·67	18·37	18·07	17·77	17·46	17·16	16·86	16·56	16·26
83·25	16·75	20·12	19·81	19·51	19·21	18·91	18·61	18·31	18·01	17·71	17·41	17·11	16·81	16·51	16·21	15·91
83·50	16·50	19·76	19·46	19·16	18·86	18·56	18·26	17·96	17·66	17·36	17·06	16·76	16·46	16·16	15·86	15·56
83·75	16·25	19·40	19·10	18·80	18·50	18·20	17·91	17·61	17·31	17·01	16·71	16·41	16·11	15·82	15·52	15·22
84·00	16·00	19·04	18·75	18·45	18·15	17·85	17·55	17·26	16·96	16·66	16·36	16·07	15·77	15·47	15·17	14·88
84·25	15·75	18·69	18·39	18·10	17·80	17·50	17·20	16·91	16·61	16·31	16·02	15·72	15·43	15·13	14·83	14·54
84·50	15·50	18·34	18·04	17·75	17·45	17·15	16·86	16·56	16·27	15·97	15·68	15·38	15·08	14·79	14·49	14·20
84·75	15·25	17·99	17·69	17·40	17·10	16·81	16·51	16·22	15·92	15·63	15·33	15·04	14·74	14·45	14·15	13·86
85·00	15·00	17·64	17·35	17·05	16·76	16·47	16·17	15·88	15·58	15·29	15·00	14·70	14·41	14·11	13·82	13·52

as 38 per cent. will cause him a loss of 5 per cent. of his total butter-fat. Thus on 40 the loss is 2; on 100 the loss is $2 \times 100 \div 40$ per cent. $= 5$, or for 100 lb. fat received only 95 lb. is paid for. The butter made is still 119·09 lb., and 119·09 less 95 equals 24·09 lb. butter made in excess of fat paid for. The overrun will therefore be $24{\cdot}09 \times 100 \div 95 = 25{\cdot}35$ per cent. The increase in overrun due to the lower reading of the cream test will be $25{\cdot}35 - 19{\cdot}09 = 6{\cdot}26$ per cent. Similarly, the same error in a 30 per cent. cream will result in a loss of 6·66 per cent. of fat to the supplier, and the overrun will be increased by 8·45 per cent. Should the error result in an overcredit of 2 per cent., the overrun will be reduced by 5·68 per cent. when 40 per cent. of cream is being received, and by 7·4 per cent. with 30 per cent. of cream.

The influences of the overrun on the value of the fat may be seen in this way: If we have 100 lb. of fat and make 120 lb. of butter worth 1s. per pound, 1 lb. of fat is worth 120s. $\div$ 100 $=$ 14·4d. But if only 115 lb. of butter is made from 100 lb. of fat, 1 lb. of fat is worth only 115s. $\div$ 100 $=$ 13·8d.: or 1s. $\times$ 1·15 $=$ 13·8d. The value of the overrun per pound of fat is therefore in the first case 14·4d. $-$ 12d. $=$ 2·4d., and in the second 13·8d. $-$ 12 $=$ 1·8d.

If the expense of making and marketing amounts to 1·8d. per pound of fat the factory will be able to pay out 1s., the same price as received for butter when the overrun is 15 per cent., but if the expenses exceed 1·8d. the payment for butterfat will be less per pound than was received for butter. But with a 20-per-cent. overrun and the same manufacturing costs the factory can pay 14·4d. $-$ 1·8d. $=$ 12·6d. per pound, or 0·6d. more than was received per pound for butter. Assuming that each supplier has been credited with his correct amount of fat, and that the reduced overrun is the result of faulty manufacturing methods, the loss falls equally on all suppliers. But should the low overrun be the result of error in weighing, testing, &c., it is only one of calculation, and will fall unfairly on certain suppliers.

Taking three suppliers sending in 30, 40, and 50 per cent. cream, and assuming they are credited with 31, 41, and 51 tests. The first will be paid for 3·33 per cent. too much fat; the second will be paid 2½ per cent. too much; and the third will be paid for 2 per cent. too much. Since the percentage of error is not evenly distributed, and there is only a certain sum available for distribution, the first will receive more money than he is entitled to, and the second will receive a fair proportion, and the third less than he is entitled to. Should the error result in a similar reduction in test the first will receive less than his due, the second will receive the same, and the third more money than he is entitled to.

CONCLUSION.

From the foregoing it will be seen that the overrun plays a very important part in the affairs of a dairy factory, and the necessity for checking it at each testing-period cannot be too strongly emphasized. The greatest care is required from the time the milk or cream is received until the butter is packed, and each step of the process must be carefully checked in order to avoid unnecessary losses.

Putting aside the accurate testing of milk and cream, which have been fully dealt with on many occasions, practical and reliable tests are available with which all buttermakers are familiar. Of these the moisture and salt tests are the most important, as they determine the fat content of the butter and to a great extent the overrun. Manufacturing losses cannot be reduced below a certain minimum, as a percentage of loss is unavoidable, while the curd content of butter cannot be increased without endangering the keeping-qualities of the butter. The factors of moisture and salt, however, are within certain limits, in the hands of the buttermaker.

DIPLODIA CANKER, DIPLODIA GRIFFONI.

A COMMON FUNGOUS DISEASE OF THE APPLE.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

DIPLODIA GRIFFONI (Griff. et. Maublanc) Sacc. et Trav. ranks second in importance only to black-rot as a canker-forming disease of the apple. It was first recorded for New Zealand in 1916, from specimens forwarded by R. Waters to Kew. It has been confused by several authorities with black-rot, and until recently was constantly referred by the writer to that disease. Recent cultural work performed in this Laboratory shows that the diseases are quite distinct.*

The disease appears to have a limited distribution, for elsewhere it has only been recorded from England and France, where it appears to be a minor disease. So far as is at present known, in New Zealand it is confined to the apple, although in France it has been also recorded on the pear.

APPEARANCE AND EFFECT ON THE HOST.

The disease is prevalent on young laterals, but is not confined to these, for it is occasionally found on two- and three-year-old wood. When attacked the lateral is soon girdled, and the leaves wilt and turn brown, thus rendering the presence of the disease noticeable, for these wilted shoots present an appearance very similar to those infected with fireblight. It cannot be considered a serious disease, for it ranks second in importance to black-rot as a disease of the apple, and it has been already pointed out (*Journal* for August last) that in New Zealand black-rot is in itself a comparatively minor trouble.

When the canker thus formed is carefully examined it is seen to possess several features which separate it from black-rot and other cankers. It is slightly depressed, and is well defined from the healthy wood by one or more deep crevices with slightly raised margins. The colour is a distinct reddish-brown, with a conspicuous arrangement into light and dark bands, giving the whole canker a zoned appearance. It will be remembered that the black-rot canker is also zoned; in this case, however, the zones are due to definite crevices, and not to

* A detailed account of this cultural work will be published elsewhere.

colour. Diplodia canker is rendered still more conspicuous on account of the whole surface being studded with the fructifications of the causative organism. These appear as small conical elevations, also arranged in zones.

On older wood an elliptical sunken canker is formed. It is, as a rule, confined to one side of the branch, so girdling does not occur; consequently in the absence of wilted leaves this stage is easily overlooked. For a time they present a similar appearance to cankers on the laterals; later they change to a dull brown, and in very old specimens the bark may fall away in strips, exposing the wood and giving the wounds a ragged appearance.

FIG. I. DIPLODIA CANKER ON YOUNG TWO-YEAR-OLD BRANCH. × 2.

Point of entry through woolly-aphis injury. Note the numerous pycnidia.

[*Photo by G. H. Cunningham.*

FIG. 2. CANKER ON THREE-YEAR-OLD BRANCH. NATURAL SIZE.

Note sunken nature of the canker, and the zoned arrangement of the pycnidia. Point of entry through broken stub.

[*Photo by W. D. Reid.*

I have not found this fungus on fruits in nature, but when artificially inoculated into apples it produces a firm brown rot. On the surface appear numerous black raised points, the fructifications of the fungus.

LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

There are two spore stages in the life-cycle of this fungus. Shortly after a canker is formed numerous black papillæ appear beneath the dead bark. Microscopic examination shows these to consist of small flask-shaped pycnidia, containing very numerous, large, one-celled, colourless spores. This is the first or *Macrophoma* stage. Should the canker persist for some time the spores change in colour to dark brown and become one-septate, producing the second or *Diplodia* stage. The latter is a comparatively rare stage, the abundant one being the *Macrophoma*.

I have recently proved by cultural work that these two stages belong to the same cycle. *Macrophoma* spores were sown on various culture media, and after a time in certain of the media the *Diplodia* stage appeared.

The fungus is apparently able to penetrate the tissues only through some injured surface. Field observations show that the chief source of infection is through woolly-aphis injuries, but infection through stubs left as a result of careless pruning is not uncommon. Should a spore be carried to such a surface it may germinate and produce a hypha, which penetrates into the tissues and there divides repeatedly to form a mycelium. The hyphæ penetrate into the tissues of the cortex and wood, growing radiately outwards from the infection centre. Should the shoot be a small one girdling quickly follows. Sections

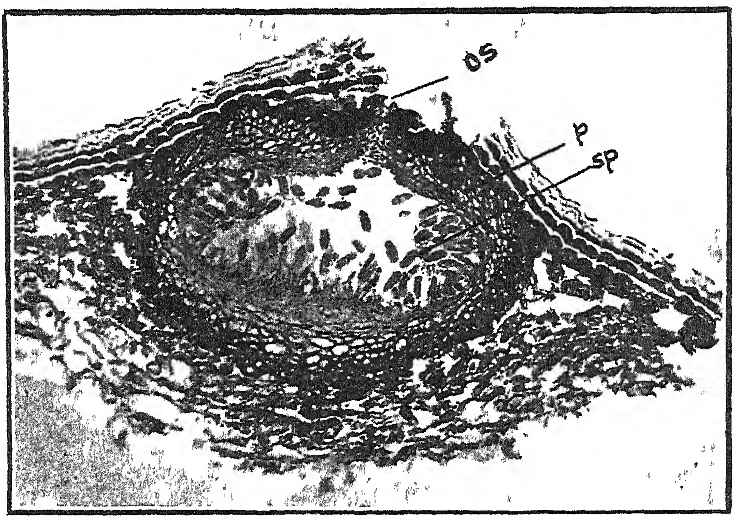


FIG 3. PHOTOMICROGRAPH OF A SECTION THROUGH PYCNIDIUM × 75

(*p*) Pycnidial wall, (*os*) ostiolum; (*sp*) spores.

[*Photo by G. H Cunningham*

through old cankers show that the hyphæ of the fungus penetrate through cortex, bast, and wood tissues, killing and discolouring them.

The mycelium persists in a canker, especially one on an older limb, for two or more seasons. Under favourable conditions it produces fructifications on the surface of the canker throughout the whole of this period. These fructifications are flask-shaped receptacles, opening by a pore (ostiolum) on to the free surface of the canker. The enclosed spores are embedded in hygroscopic mucilage, which in a humid atmosphere absorbs water, swells, and is forced out through the ostiolum to the surface, where it appears as a gelatinous tendril in which are embedded the spores.

The mucilage is dissolved by rain, and the spores lie free on the surface of the bark. When dry they are carried long distances by

the wind. It is probable that insects play an important part in their distribution. The fungus is not confined to the living host, for I have very frequently obtained this species on dead twigs (apple) lying on the ground in the orchard and in heaps of prunings. Spores from such sources give the same growth in culture media, and produce the same rot in apple fruits as those taken from cankers. I have been able to infect apple-shoots with spores (*Macrophoma*) produced in culture by introducing them into wounds artificially made in the cortex, but have failed to infect leaves either directly or through wounds in the epidermis.

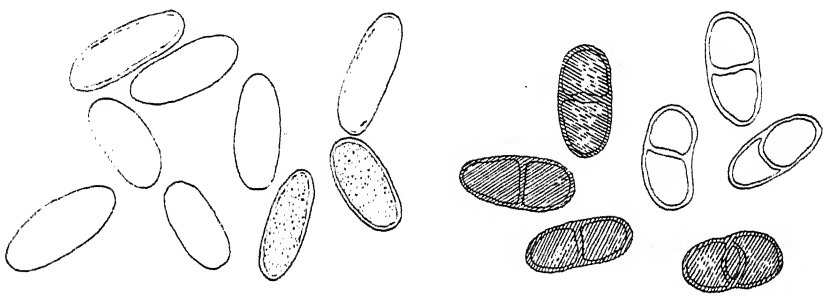


FIG. 4 (LEFT). MACROPHOMA SPORES. × 500.
FIG. 5 (RIGHT). DIPLODIA SPORES. × 500.
[*Original.*

REMEDIAL TREATMENT.

It has been shown that this organism is spread from spores produced from fructifications embedded in the dead bark of cankers, and that the fructifications may be formed at any time during the life of the canker, the mycelium being perennial. It is seen that twigs left on the ground or in heaps or prunings—twigs on which the fungus is living as an ordinary saprophyte—are also a source of infection. Further, it has been shown that infection can occur only through wounds in the bark, principally through injuries caused by woolly aphis.

The following remedial treatment is suggested: (1) Removal of the sources of infection, and (2) the prevention of infection by wound-treatment. Unfortunately, in the latter case this would necessitate the control of woolly aphis—a difficult task—as it is through injuries formed by these aphids that the majority of infection occurs. I believe that this phase may be ignored, and that if the sources of infection be removed the disease will soon prove to be a negligible one. This would not prove a difficult matter, for, so far as is at present known, the fungus in New Zealand is confined to the one host plant; I have not succeeded in obtaining the spores, even on dead wood, on other than the apple.

To summarize: (1) Cut out all cankers whenever they appear; (2) carefully rake up and destroy all prunings; (3) burn all heaps of prunings and do not allow them to lie about, for they are a fruitful source of infection; (4) keep woolly aphis in check.

GENERAL SUMMARY.

1. *Diplodia* canker is a fungous disease confined to the apple. It forms cankers on laterals and branches. It has not been found on leaves or fruits in nature.

2. Cankers caused by it may be readily recognized on account of the characteristic light and dark bands of reddish-brown colour.

3. There are two spore stages in the life-cycle, a *Macrophoma* followed by a *Diplodia* stage. They have been connected by the aid of cultures.

4. The fungus overwinters in the cankers and on dead twigs on the ground and in pruning-heaps.

5. It is a wound parasite, entering principally through woolly-aphis injuries.

6. Remedial treatment suggested is the removal of sources of infection and the keeping in check of woolly aphis.

LITERATURE CONSULTED.

SACCARDO, P. A., AND TRAVERSO, J. B. (1913): *Sylloge Fungorum*, vol. 22, p. 994.

ALCOCK, MRS. M. L. (1923): A Die-back in Sussex, *Trans. Brit. Myc. Soc.*, vol. 8, p. 190.

GORE EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1922–23.

R. B. TENNENT, Instructor in Agriculture, Dunedin.

THE season 1922–23 in the Gore district was a very wet one, as a result of which some of the operations carried out on the experimental area received a set-back during the initial stages of growth, resulting in difficulty being experienced in the harvesting and weighing of the various crops. The following brief summary of operations will prove of interest to farmers in Otago and Southland, but it should be borne in mind that the Gore area, properly speaking, is a demonstration rather than a true experimental area. The work being carried out is so designed as to give an indication in regard to the suitability or otherwise of certain crops in the locality where the area is situated, and also, by preliminary trial, to pave the way for more exhaustive experiments where indications have been obtained that such are likely to meet with success.

MAJOR WHEAT.

As a result of the success of Major wheat at Winton Experimental Area during the season 1921–22, where it gave a per-acre yield of 62 bushels, weighing 65½ lb. of dressed seed per bushel, it was decided to lay down 3 acres of this variety at Gore for seeding purposes. The quick-germinating properties of this seed were again noticed, and, as had previously been observed, the crop came to maturity a full three

weeks ahead of Solid-straw Tuscan. This, to Southland farmers in particular, is a valuable feature, and the fact also that Major stands up well with little susceptibility to lodging makes it, from a farmer's point of view, a highly desirable variety to grow. The wheat handles well and is easily threshed. Sown at the rate of 3 bushels, and with 3 cwt. superphosphate per acre, the crop when threshed gave 60 bushels per acre—quite a creditable yield.

This, together with other trials, having proved quite satisfactory, a quantity of Major wheat was forwarded to the mill of Messrs. W. Reid and Sons, Arrowtown, for a report in regard to its actual milling-characteristics. The wheat was carefully tested by Mr. Warring, the miller, and a report upon it furnished by him reads as follows:—

> This wheat was in very soft condition, and therefore not capable of being easily handled on mill. On the breaks it behaved fair, but, owing to the rolls having to be put up, gave an excessive percentage of "break" flour. On the reduction rolls it was necessary to come up off the stock, otherwise it flaked badly. Possibly owing to its condition, it dressed very poorly, and gave a low percentage of flour and a correspondingly high percentage of pollard. Flour inclined to be dark and slippery. However, sample not altogether the best for a flour test, owing to its condition; but inclined to think this wheat at best only suitable for blending purposes. The net weight of wheat was 422 lb., less loss in screening and milling, 12 lb., equal to 410 lb., producing as follows: Flour, 254 lb. = 61·95 per cent.; bran, 54 lb. = 13·17 per cent.; pollard, 102 lb. = 24·88 per cent.

From this report it will be observed that the sample forwarded was of poor milling-quality, but, as mentioned in the report, the sample was not a good one on account of the bad weather prevailing at harvest-time. The three chief varieties of wheat grown in Southland are Solid-straw Tuscan, White-straw Tuscan, and Velvet. During the season 1920–21 samples of these were collected from Southland, and milling tests were conducted by the Department's Chemical Laboratory. To contrast Major grown during the season 1922–23 with these wheats may not be a fair comparison, but will certainly prove interesting in showing the relatively poor position held by Major, as follows:—

Locality.	Variety.	Bran.	Pollard.	Flour.	Season.
		Per Cent.	Per Cent.	Per Cent.	
Gore	Major	13·17	24·88	61·95	1922–23.
Wrey's Bush ..	Velvet	13·7	14·7	71·6	1921–22.
Winton ..	Velvet	15·6	12·9	71·5	1921–22.
Athol	Solid-straw Tuscan ..	10·9	17·2	71·9	1921–22.
Wendon ..	White-straw Tuscan	15·3	14·5	70·2	1921–22.
Winton ..	White-straw Tuscan	13·7	14·8	71·5	1921–22.

From this it will be seen that so far as the 1922–23 sample of Major wheat was concerned its milling-qualities were so poor that one now feels diffident about recommending the growing of this variety until further tests have been made. A wheat which matures early, yields well, and has strength of straw is, in spite of such desirable characteristics, much discounted for Otago and Southland farmers if its milling-properties are not as good as the wheats already grown in these districts. Further trials are therefore being made with Major in order to definitely fix its relative value.

OATS AND PEAS FOR ENSILAGE OR HAY.

An area of approximately 4 acres of Garton's oats and Grey Partridge peas was grown for the purpose of providing sufficient green material to build an ensilage stack. The crop was put in on 18th October, 1922, at the rate of 1½ bushels oats and 1½ bushels peas, mixed, and sown with a Massey-Harris seed-drill. A mixture of oats and peas can be sown quite conveniently in this manner.

Associated with this crop was a manurial trial. The field was divided into five sections, four of which received different manures, one being retained as a control plot. The crop was harvested on 1st February, and the following green-weight yields were recorded: Plot 1, unmanured, 15 tons 6 cwt.; plot 2, 2 cwt. superphosphate, 15 tons 12 cwt.; plot 3, 1 cwt. superphosphate and 1 cwt. Nauru phosphate, 14 tons 18 cwt.; plot 4, 1 cwt. basic slag and 1 cwt. superphosphate, 13 tons 10 cwt.; plot 5, 2 cwt. basic superphosphate, 13 tons 6 cwt.

From these results it can at once be seen that no reliable information in regard to the relative value of different manures can be obtained from experiments laid down in this manner. No allowance for soil-variation was made, and as a result the unmanured plot, which was obviously on the best ground, gave the second-highest yield. All attempts to ascertain the effect of different manures are quite ineffective when carried out on these lines, and it is only by having a multiplicity of plots of each kind of manure that a fairly accurate estimate of the value of such manures can be obtained. The experiment therefore is of value inasmuch as it shows how impossible it is to arrive at satisfactory results by such means, and this should be noted by farmers who carry out private experimental work of this nature.

The crop was converted into ensilage, for which purpose oats and peas are admirably adapted. The value of this combination as a hay crop is also recognized, and it is to be recommended as specially suitable for this purpose in Otago and Southland, where a larger acreage should be grown. Its value as a summer forage is not sufficiently recognized. Sown during the first week of November this crop should be in good condition for feeding green to dairy cattle during the usually dry months of January and February.

OATS AND GOLDEN TARES.

A small block of 1½ acres of oats and Golden tares was also sown for ensilage purposes, in the same manner as the oats and peas. There does not appear to be any great advantage in sowing tares in preference to peas, and the price of tares is much higher than that of peas. This block was divided into two sections, one of which received 2 cwt. per acre of Nauru phosphate, the remaining block being unmanured. The manured area gave a green-weight yield of 11 tons 1 cwt. per acre, and the unmanured block yielded 10 tons 8 cwt. per acre. As in the case of the oat and pea crop, no inference is to be drawn from the apparent beneficial effect of the manure used, as the difference in the yield could just as easily be accounted for by variations in the soil.

Apart from the value of this crop for ensilage and hay purposes, it is especially suited for autumn sowing, to provide early spring feed.

Tares do well when autumn-sown where peas would fail, which is a valuable characteristic. As a smother-crop oats and tares are of great value in suppressing the growth of Canadian thistle, and they have been tested at Gore with excellent results for this purpose.

RAPE VARIETIES.

As in the past, a portion of the area was devoted to demonstrating the growth of different varieties of rape. All were sown on 28th October (with the exception of Smith's Broad-leafed Essex, which was sown on 29th November) in ridges, at 1 lb. per acre, with 1 cwt. each per acre of Nauru phosphate, blood-and-bone, and superphosphate. The varieties tested, with their yield per acre, were as follows: Plot 1, Colonial, 22 tons; plot 2, European, 20 tons 11 cwt.; plot 3, Kangaroo, 20 tons 5 cwt.; plot 4, Gigantic, 14 tons 2 cwt.; plot 5, Buda kale, 17 tons 6 cwt.; plot 6, Smith's Broad-leafed Essex, 18 tons 8 cwt.

The individual plots were too small to fence off in order that their relative fattening-qualities could be assessed, so the whole block was fed off with lambs. These were weighed on the block on 4th March, their average weight per head being 80·1 lb. They were taken off on 15th March, and gave an average weight of 81·4 lb., showing an increase in weight for the ten days' grazing of 1·3 lb. per head.

It is pleasing to note that Colonial gave the highest yield, which goes to bear out our repeated assertion that New Zealand can grow rape-seed equal to the best European. Gigantic proved a poor yielder and did not come up to expectations. The variations of results in these yields may not in every case be due to the superiority of one variety over the other, for it has to be borne in mind that the soil was, to say the least, very variable.

WINTER FORAGE CROPS.

A trial of winter forage crops was conducted on approximately 1¼ acres, with the object of demonstrating to farmers the value of certain crops as winter feed for dairy cattle. It is not sufficiently recognized that very satisfactory winter forage crops can be grown in Otago and Southland quite apart from turnips, and those farmers who visited the Gore area last season expressed themselves as agreeably surprised in this respect.

The crops dealt with were Thousand-headed kale, chou moellier, and two varieties of cabbage. They were sown on 28th November in raised drills, at the rate of 1 lb. per acre, with the same manures as used with the rape crops. Good germination resulted, and when final weighings of the crops were made during the month of June the following yields per acre were recorded: Thousand-headed kale, 11 tons 14 cwt.; chou moellier, 24 tons 10 cwt.; Drumhead cabbage, 19 tons 4 cwt.; Succession cabbage, 20 tons 1 cwt.

In weighing these crops the plants were cut off level with the ground, no roots being weighed. Succession appeared to be the better of the two cabbage varieties.

Observations in regard to palatability were made, and it was noticed that the sheep appeared to prefer the crops in the following

order: chou moellier, Thousand-headed kale, Succession cabbage, and Drumhead cabbage. The preference of the sheep for chou moellier was most marked. There can be no doubt that for a winter forage crop chou moellier has a great deal to recommend it. Even on club-root infected ground chou moellier, although susceptible to the disease, is not seriously damaged by it; and, as a matter of fact, club-root does not seem to materially affect the growth of the plant. As a fodder for dairy cattle it is difficult to surpass, and the fact that it does not taint milk makes it, from a dairy-farmer's viewpoint, an excellent crop to grow for both summer and winter feeding.

SOFT-TURNIP VARIETIES.

A block of different varieties of soft turnips always appeals to the Southern farmer, who depends to a very large extent on turnips for winter feeding. The regular practice of testing different varieties of turnips on the Gore area was again carried out, and an area of 2 acres was devoted to this purpose. The turnips were sown in ridges on 18th December, at 1 lb. per acre, with the same manure as for the rape (1 cwt. per acre each of Nauru phosphate, blood-and-bone, and super). Nineteen varieties were sown, and observations in regard to their freedom or otherwise from attack of club-root were noted, the results being as follows:—

Variety.	Yield per Acre. Tons	Yield per Acre. cwt.	Infection by Club-root.
Paragon Red (Canterbury-grown seed)	21	2	16·6 per cent.
Hurst's Devonshire Greystone	20	2	Very slight.
Smith's Improved Green Globe	25	3	Very slight.
Hurst's Purple-top Aberdeen	16	7	Very slight.
Hurst's Fosterton Hybrid	19	16	2 per cent.
Hurst's Imperial Green Globe	25	3	2 per cent.
Hurst's Centenary	26	16	Slight.
Hurst's Green-top Aberdeen	16	7	7 per cent.
Garton's Hardy Green Globe	27	17	Slight.
Deep Golden Yellow Long Keeping	19	16	Slight.
Smith's Purple-top Bullock	21	0	Slight.
Webb's New Renown	21	8	10 per cent.
Webb's Purple-top Scotch	15	10	22 per cent.
Webb's Yellow Tankard	24	13	Slight.
Kelway's First-in-the-Field	22	6	Slight.
Kelway's Green Ring	29	9	Slight.
Smith's Sittyton Prize Green-top Yellow	22	10	4 per cent.
Garton's Hardy Green Globe	25	9	9 per cent.
Hardy Green Globe (Canterbury-grown seed)	26	16	3 per cent.

The above gives no true indication in regard to the relative yields of the respective varieties, and is merely included in this report with the object of showing that the majority can quite safely be tried out on the farms of the district. In regard to the last two plots, the area laid out in each of these varieties was approximately ½ acre. The two varieties made a very interesting comparison, and a marked superiority of the New Zealand seed over the European was noted. The ultimate yield recorded for the former was higher; but by far

the most important fact noticed was that the crop grown from New Zealand seed was much less infected with club-root and dry-rot than that from European seed.

SWEDE VARIETIES.

A number of swede varieties were sown on 28th November with the same manure as used for the soft turnips. The varieties were weighed after being topped and tailed, and an examination was made in regard to their freedom or otherwise from club-root. Particulars are as follows:—

Plot.	Variety.	Yield per Acre.		Infection by Club-root.
		Tons	cwt.	
1	Webb's New Buffalo	31	1	Very slight.
2	Webb's New Masterpiece	24	13	3 per cent.
3	Webb's Short Top	20	2	Very slight.
4	Webb's Arctic	29	9	Very slight.
5	Webb's Golden Melon	19	16	Very slight.
6	Webb's New Empire	25	3	Very slight.
7	Kelway's Brown Universal	28	0	Very slight.
8	Kelway's Longport Green-top	25	15	Very slight.
9	Kelway's Best of All	31	1	9 per cent.
10	Garton's Superlative	33	9	Very slight.
11	Bell's Mervue	32	3	8 per cent.
12	Smith's Defiance	27	0	23 per cent.
13	Hurst's Universal	31	1	24 per cent.
14	Hurst's Perfection	32	3	9 per cent.
15	Hurst's Monarch Purple-top	29	9	3 per cent.
16	Danish Swede	27	17	30 per cent.
17	Crimson King (Canterbury-grown seed)	31	12	20 per cent.

As was the case in the soft-turnip variety trial, no true inference can be drawn in regard to the relative yield of the different varieties, on account of soil-variations, nor in regard to their apparent degree of club-root resistance. One must assume that the degree of infection is only an indication in regard to the location and intensity of infection in the particular field.

The main crop of swedes consisted of an imported Danish variety (which must not be confused with a Danish variety that is being tried on the area in relation to its club-root-resistant properties) and Crimson King from seed grown in Canterbury. The Canterbury-grown seed produced a crop which appeared to be much freer from dry-rot and club-root than the imported Danish swede.

CLUB-ROOT INVESTIGATION.

A continuance of the club-root investigation afforded some interesting results during the season. Readers are referred to previous reports on the Gore area for full information in regard to the work being done. From these it will be noted that the efficacy of lime is being tested as a means of controlling or limiting this disease, and a crop rotation is simultaneously being carried out with the same object in view. The results recorded in 19 2–23 are as follows:—

Plot.	Quantity of Lime per Acre, applied 1920.	Yield per Acre.		Percentage of Club-root Infection.
Block A, sown with Hardy Green Globe Turnips.				
	Tons.	Tons	cwt.	
1	2	22	6	57·0
2	16	28	0	3·0
3	Nil	25	9	48·3
4	8	35	6	24·0
5	4	31	0	20·8
Block B, sown with Webb's Renown Turnips.				
	Tons.	Tons	cwt.	
1	2	20	2	9·5
2	16	25	0	9·6
3	Nil	16	0	21·6
4	8	26	16	12·0
5	4	24	13	16·8

These results afford interesting material for thought, and apparently point to lime, after being several years in the soil, having some inhibiting effect on the prevalence of the club-root organism. Where large quantities of lime have been applied, as in the case of the plot which received 16 tons per acre, there was certainly less disease apparent than on the plot which received no lime. One would like very much to use these results as an argument that lime when applied in fairly large quantities would lessen the disease, but the figures must not be accepted at their face value as giving a true indication of the intensity of attack. The plots were small, and the bulbs grown thereon few in number. One or two bulbs attacked by the disease consequently make the percentage of infection read very high. Furthermore, there is every likelihood that the ground upon which the experiment is being tried is not uniformly infected in the same intensity, and this would certainly make for wrong interpretation of results. All that can be said in regard to this experiment is that a strong indication was given supporting the oft-repeated assertion that lime counteracts club-root; further, as a result of the previous experiments it would appear that the effect of lime in this connection is not apparent until some three years after the application has been made.

GENERAL.

The lucerne trial was continued, and several new varieties were sown down. From indications up to the present there is apparently no doubt as to the unsuitability of lucerne for this district, and it cannot be recommended as a crop on land of similar type to that of the Gore area.

Mangolds were grown on the heaviest piece of land on the area, and the results were quite satisfactory in evincing the fact that there are undoubtedly many places in Southland where this crop can be satisfactorily grown.

The season 1922–23 was remarkable for the keen interest taken in the farm operations by the general farming community. The number of visitors was large, and several field-days were given to different branches of the Farmers' Union.

The work on the area was most satisfactorily carried out by the Overseer, Mr. T. Pattinson, who deserves credit for the manner in which he laid out the experiments and attended to the farm operations generally.

TESTING OF PUREBRED DAIRY COWS.

NOVEMBER CERTIFICATE-OF-RECORD LIST.

W. M. SINGLETON, Director of the Dairy Division.

THE appended list, comprising the records of 162 cows which received certificates during November, 1923, forms the largest number of certificates issued in any one month since the inception of the C.O.R. testing system in New Zealand. That quality is represented, however, as well as quantity will be apparent from a glance at the records —two cows having produced over 800 lb., four others over 700 lb., and fifteen over 600 lb. of butterfat.

NEW JERSEY CLASS-LEADERS.

Alfalfa Pansy.

In the junior two-year-old section for Jerseys appears Mr. F. J. Saxby's Alfalfa Pansy, whose yield of 690·16 lb. butterfat places her at the head of that class. But though she has displaced Aster's August Child, the previous leader, the margin between the two records is only 1·01 lb. fat. Alfalfa Pansy commenced her test at 2 years 4 days, as compared with 1 year 337 days in the case of Aster's August Child. There is, therefore, a difference of thirty-two days in age, which at the usual rate of increase in standard for age would represent 3·20 lb. fat.

Alfalfa Pansy was sired by Waipiko Masterpiece, and her dam is Woodruffe, who at the age of 15 years 276 days commenced a C.O.R. test on which she qualified with a production of 436·01 lb. fat, a fine performance considering her advanced age. Another daughter of Waipiko Masterpiece is Alfalfa Cicero Fontaine (also owned by Mr. F. J. Saxby), whose record of 665·74 lb. fat at 2 years 69 days is not very far below that of the animal under review. Waipiko Masterpiece was sired by Eminent's Fontaine, and his dam also traces to that sire. It would therefore seem that this source may be largely responsible for the merit of Alfalfa Pansy. Woodruffe, the dam of Alfalfa Pansy, was almost fifteen years old when this daughter was born, so that her ancestors had passed their prime before the certificate-of-record testing system was properly founded in New Zealand, and therefore have few records to show. However, such widely recognized individuals as Dry Monopole, Retford, Magnet's Boy, and Grisette have doubtless left their mark.

It may be mentioned that Alfalfa Pansy's highest month was the fourth one of the test, when she yielded 68·65 lb. fat, while for her final month—August—she is credited with 56·90 lb. fat in 29 days, thus showing that she had the ability to maintain her yield both against the inclement months and advancing pregnancy—a clear demonstration of sound constitution.

Marshland's Stylish Princess.

The November *Journal's* list included in the class for senior two-year-old Jerseys the name of Marshland's Eminent, who, commencing test at the age of 2 years 328 days, produced 712·08 lb. fat, and of Marshland's Stylish Princess, who yielded 715·75 lb. fat, commencing test at 2 years 353 days. Both these heifers are owned by Mr. W. J. Chynoweth, of Pukeroro, Hamilton, and both have exceeded the record of the previous leader of their class—namely, Lady Superior—who is credited with 680·33 lb. fat in 365 days, commencing at 2 years 183 days. Marshland's Stylish Princess, having the higher record, is, of course, entitled to the class-leadership, although on performance under test there is obviously little to choose between these two high-yielding youngsters.

Marshland's Stylish Princess is by Briar's Twylish, who has four other C.O.R. daughters to his credit, all with worthy performances. Briar's Twylish is by Lord Twylish (imp.), who has eight C.O.R. daughters, and from Briar Rose, who, in the first year of C.O.R. testing in New Zealand, gained a certificate for 464·14 lb. fat in 334 days, at 7 years 308 days. Briar Rose is by King Thistle (two C.O.R. daughters) from Orange Rose, with a certificate for 553·01 lb. fat, at 10 years 333 days, gained in the second year of the C.O.R. system. She is by Belvedere Bobs, who has four C.O.R. daughters. The dam of Marshland's Stylish Princess is Glenwood's Princess, who has earned two certificates, one for 412·84 lb. fat as a senior three-year-old, and another for 484·84 lb. fat in 300 days as a mature cow. It will thus be seen that Marshland's Stylish Princess has a strong butterfat-record backing.

Space will not permit treating the pedigree of Marshland's Eminent, whose name was doubtless suggested by her paternal grandsire Eminent's Fontaine, but it may be mentioned that the only similarity in breeding comes from Briar Rose, already referred to, who is the dam of Marshland's Eminent and the granddam on the sire's side of Marshland's Stylish Princess, the new leader.

Zola of Rosy Creek.

Another new class-leader whose record appeared in last month's list is Zola of Rosy Creek, owned by Mr. E. Joyce, of Kaponga. This young cow produced 741·20 lb. fat, thus defeating the record of Woodstock's Baby, the previous leader of the three-year-old Jerseys by no less than 83·29 lb. It may be mentioned that 1923 has brought out a particularly strong class of three-year-old Jerseys. In addition to Zola of Rosy Creek, three others have defeated the previous champion for the class—Mr. E. Joyce's Farce, with 691·54 lb.; Mr. F. J. Saxby's Twylish's Daisy, with 704·24 lb.; and Mr. C. G. C. Dermer's Waipiko Gerda, with 710·75 lb. fat.

Zola of Rosy Creek was bred by Messrs. A. and J. O'Donnell, of Inaha, and is by Bilberry's Twylish out of Zola. Bilberry's Twylish has qualified for the special champion butterfat bull class recognized by the New Zealand Jersey Cattle Breeders' Association—that is to say, he has sired five daughters which are from different dams and have doubled their butterfat requirement for certificate. The fact that he is now in this class must stamp him as an outstanding sire

capable of transmitting his butterfat-producing qualities. He is by Lord Twylish (imp.) — sire of eight C.O.R. daughters — from Gould's Bilberry V, a good old foundation cow, who was sired by the well-known K.C.B. Zola, dam of Zola of Rosy Creek, has a certificate for 472·26 lb. fat as a senior three-year-old. Her sire is Belvedere Sun Prince, who has sixteen C.O.R. daughters, and has also qualified for the champion butterfat class just referred to. Belvedere Sun Prince was sired by K.C.B. (twenty-nine C.O.R. daughters). Gloire de Dijon 3rd, the dam of Zola, was one of the first cows to be entered for C.O.R. test, and has a record of 293·40 lb. fat in 245 days at 3 years 32 days. She was sired by Blizzard, who has seven certificated daughters to his credit. Zola of Rosy Creek, therefore, has a very strong ancestry, particularly so far as males are concerned, and, properly mated, should be a link in the chain to still greater achievement.

In concluding these brief pedigree notes on Jersey leaders it is gratifying to mention that so far this year four out of the five classes into which the breed is divided have had the previous leaderships surpassed, the record of Mr. A. J. Smith's St. Lambert's Bell, leader of the four-year-olds, being the only one that remains.

Pretty's Flirt.

We have pleasure in recording that Pretty's Flirt, the 1,010 lb. Jersey champion, whose performance under certificate-of-record test was referred to in last month's *Journal*, has now fully qualified for certificate by producing a heifer calf on 7th December. The calf was sired by Jersey Brae's Progress, bred by Mr. T. Church, of Te Rapa, a bull 87 per cent. of the strain of Eileen's Fox, a son of Majesty's Fox, the well-known Jersey sire, who has thirty C.O.R. daughters to his credit. Although Jersey Brae's Progress is very closely inbred, the strains represented are in no case the same as those contained in the breeding of Pretty's Flirt. It will therefore be interesting to see how these two distinct lines will nick.

THE AYRSHIRE BREED: DIMPLE OF EDENDALE.

Mr. W. Hall, of Lepperton, has been successful in gaining the leadership of the two-year-old Ayrshire class with his fine heifer Dimple of Edendale, whose record of 529·46 lb. fat appears in the current list. She was sired by Dominion Beauty's Bonus (bred at the Moumahaki Experimental Farm), who carries similar strains to Auchenbrain Brown Kate IV, at one time the champion Ayrshire butterfat cow of the world. The same strain also appears on the dam's side, though further back.

The Ayrshire breed has proved its worth in many parts of the world, and here in New Zealand a number of good performances have been recorded. We have always regretted that Ayrshire breeders have not patronized the certificate-of-record testing in proportion to the entries from other breeds. We believe that the Ayrshire ranks high among the special-purpose dairy breeds, and only by means of authenticated butterfat yields can its breeders hope to gain that recognition, or the breed to secure that development, which the Ayrshire merits.

LIST OF RECORDS, NOVEMBER, 1923.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Alfalfa Pansy ..	F. J. Saxby, Ohaupo	2 4	240·9	365	10,898·1	690·16
Crofton Countess ..	R. C. Jury, Tikorangi	1 354	240·5	365	10,874·3	677·01
Waipiko Jolly ..	C. G. C. Dermer, Waipiko	1 350	240·5	365	11,512·9	610·40
Meadowvale Perfect Day	E. O'Sullivan and Sons, Tariki	1 345	240·5	365	9,322·4	574·76
Waipiko Carissima ..	C. G. C. Dermer, Waipiko	1 347	240·5	365	11,605·6	551·64
Alfalfa Madam ..	F. J. Saxby, Ohaupo	2 3	240·8	365	8,530·9	526·70
Linden Grove Silver Bell	Mrs. M. A. Gadsby, Stratford	2 34	243·9	365	8,207·8	524·23
Meadowvale Endeavour	E. O'Sullivan and Sons, Tariki	1 352	240·5	365	7,855·2	523·89
Spring Song of Rosy Creek	L. Kavanagh, Hawera	1 347	240·5	365	9,816·5	518·74
Kuku Priscilla ..	R. L. Horn, sen., Ohau	1 340	240·5	365	10,214·1	490·83
Rosy Creek Lingerie	L. Kavanagh, Hawera	1 337	240·5	365	8,767·6	484·20
Meadowvale la Gamboge	E. O'Sullivan and Sons, Tariki	2 10	241·5	365	7,478·5	483·08
Ashton Lady Linda	R. L. Parkin, Fitzroy	2 12	241·7	365	7,672·9	477·41
Holly Oak Genoeve	G. B. Hull, Silverstream	2 0	240·5	365	9,177·7	474·89
Marina of Rosy Creek	A. and J. O'Donnell, Hawera	1 342	240·5	365	9,532·8	473·65
Grannie's Joli ..	A. J. Hale, Hillsborough	2 10	241·5	365	6,926·2	470·13
Ashton Majesty's Jewel	R. L. Parkin, Fitzroy	1 328	240·5	363	7,744·7	467·07
Signor's Fancy ..	G. Buchanan, Paeroa	1 314	240·5	365	7,719·0	463·46
Maori Beauty's Doreen	W. T. Williams, Pukehou	1 325	240·5	365	9,537·3	460·45
Meadowvale Liberty	E. O'Sullivan and Sons, Tariki	2 20	242·5	365	8,530·7	456·70
Te Maire Maid ..	R. L. Tippler, Shannon	1 364	240·5	364	9,001·6	451·81
Meadowvale Genoa Daisy	E. O'Sullivan and Sons, Tariki	2 6	241·1	365	7,444·0	440·45
Mignonne's Pride ..	J. S. T. Short, Hawera	2 34	243·9	365	7,785·6	431·83
Rockview Ruby ..	W. H. Fitness, Rehia	2 6	241·1	353	7,294·9	429·05
Arrabelle's Queen ..	E. Bennett, Cardiff ..	1 303	240·5	365	7,244·3	424·24
Realization ..	E. Bennett, Cardiff ..	1 349	240·5	365	6,665·9	420·46
Penrose Merry ..	J. B. Clemow, Stratford	2 2	240·7	365	7,186·9	417·66
Te Matai Clematis ..	L. W. and J. T. Prosser, Leeston	2 26	243·1	365	7,118·6	403·84
Miro Meadow's Carnation	A. A. Ward, Tariki ..	1 277	240·5	365	7,487·9	399·17
Hurden Beauty ..	G. E. Cowling, Manaia	1 336	240·5	365	6,460·7	392·46
Maori Butterfat ..	H. B. Lepper, Lepperton	1 357	240·5	328	7,849·7	388·84
Brookley Gem ..	W. Johnson, Ngaere	2 52	245·7	356	6,084·1	387·11
Hurden Goldsize ..	G. E. Cowling, Manaia	1 360	240·5	365	5,358·5	386·43
Solanine	G. R. and H. Hutchinson, Auckland	2 16	242·1	365	6,290·0	382·26
Arthingworth Winnie	E. Smallbone, Richmond	1 350	240·5	365	8,098·1	377·72
Silverdale Lucky ..	G. Hodgson, Whakapara	1 289	240·5	365	6,342·1	372·74

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd. for Cert.	Yield for Season. Days.	Milk.	Fat
JERSEYS—*continued.*						
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Girl Grey	R. C. Leach, Woodville	1 337	240·5	365	7,050·7	365·36
Roslyn Sweet Pansy	J. Harris, Bombay	1 353	240·5	341	5,764·8	363·36
Silverdale Butterfly	G. Hodgson, Whakapara	1 212	240·5	336	6,631·6	362·99
Hurden Queen	G. E. Cowling, Manaia	2 5	241·0	357	5,591·6	357·84
Violet King's Loveliness	J. Pill, Hawera	1 340	240·5	365	5,683·9	352·92
Waikari Iris	L. A. Higgins, Belgrove	2 15	242·0	365	6,963·2	347·74
Maori Butterfly	G. R. and H. Hutchinson, Auckland	1 328	240·5	338	6,090·4	343·44
Ashton Prairie Belle	R. L. Parkin, Fitzroy	1 324	240·5	365	6,174·4	342·94
Hurden Fury	G. E. Cowling, Manaia	2 20	242·5	330	6,766·0	342·22
Hurden Rosebud	G. E. Cowling, Manaia	2 14	241·9	348	6,347·4	334·63
Waikari Jersey Queen	L. A. Higgins, Belgrove	1 344	240·5	365	6,531·0	321·24
Kaucket Buttercup	G. T. Gibbons, Ngaere	2 79	248·4	264	5,262·7	279·71
Arthingworth Mina	E. Smallbone, Richmond	1 345	240·5	365	6,199·6	263·91
Senior Two-year-old.						
Happy Life	E. Bennett, Cardiff	2 294	269·9	365	11,641·9	664·51
Jersey Brae's Peerless	W. H. Miers, Rukuhia	2 358	276·3	365	7,702·4	541·80
Brooklyn's Cream Lady	H. J. Lancaster, Glen Oroua	2 207	261·2	365	9,988·2	532·35
Meadowvale Gambonia	E. O'Sullivan and Sons, Tariki	2 312	271·7	365	9,107·4	516·89
Meadowvale Lovematch	E. O'Sullivan and Sons, Tariki	2 267	267·2	365	9,065·2	496·07
Vulpe's Flower Girl	R. C. Leach, Woodville	2 337	274·2	365	7,759·2	480·06
Anchor	C. Stevens, Maungatapere	2 248	265·3	365	8,857·6	474·57
Meadowvale Solid Gold	E. O'Sullivan and Sons, Tariki	2 110	251·5	331	8,208·8	412·16
Holly Oak's Laura	A. J. Hale, Hillsborough	2 199	260·4	365	6,206·4	402·45
Silverdale Flora	G. Hodgson, Whakapara	2 196	260·1	266	4,435·6	274·83
Three-year-old.						
Waipiko Gerda	C. G. C. Dermer, Waipiko	3 331	310·1	365	12,375·9	710·75
Twylish's Daisy	F. J. Saxby, Ohaupo	3 350	312·0	365	11,175·1	704·24
Penrose Waif	J. B. Clemow, Stratford	3 0	277·0	365	9,927·0	594·35
Rita Molina	J. S. Rae, Taneatua	3 341	311·1	365	9,905·2	562·64
Laurel's Shiny Gem	R. C. Leach, Woodville	3 353	312·3	365	9,359·9	487·62
Brentwood's Gem	C. A. Willis, Pukekohe	3 327	309·7	364	7,954·7	486·33
Plymouth Rose	H. P. Pickerill, Kelso	3 88	285·8	338	7,525·2	451·71
Star of Eve	J. S. Rae, Taneatua	3 342	311·2	308	7,951·8	450·36
Waikari's Queen	L. A. Higgins, Belgrove	3 352	312·2	365	10,056·6	446·96
Silverdale Biddy	W. K. Mackie, Dargaville	3 4	277·4	365	7,526·2	444·11
Silverdale Nell	G. Hodgson, Whakapara	3 1	277·1	360	7,960·6	436·44

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS—*continued.*						
Three-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Pretty Maiden	G. A. Gamman, Marton	3 29	279·9	365	8,332·5	428·71
Lady Charlotte	M. Devenish - Meares, Te Puna	3 352	312·2	365	6,845·8	383·66
Myrtle's Pet	J. S. Rae, Taneatua	3 125	289·5	365	8,113·8	374·86
Royal Patritia	C. Stevens, Maungatapere	3 50	282·0	365	4,855·3	349·10
Glowing Embers	G. E. Cowling, Manaia	3 282	305·2	320	6,028·9	315·76
Broady's Princess	Mrs. M. A. Rogers, Katikati	3 47	281·7	279	5,515·4	295·69
Four-year-old.						
Twylish Rosebud	R. L. Tippler, Shannon	4 305	344·0	365	9,072·9	536·32
Magnolia Lady Hope	C. Stevens, Maungatapere	4 318	345·3	365	8,194·8	501·70
Mignonne's Pet	J. S. T. Short, Hawera	4 309	344·4	362	8,523·2	494·26
Silver Leaf	B. E. Veale, Tirohia	4 31	316·6	365	9,334·2	447·70
Rose Hellier	G. E. Cowling, Manaia	4 10	314·5	342	8,760·1	447·13
Silverdale Heather	G. Hodgson, Whakapara	4 281	341·6	338	7,043·6	427·87
Silverdale Maid	G. Hodgson, Whakapara	4 216	335·1	365	8,152·2	404·43
Mature.						
Cherry's Pet	W. Miskelly, Eltham	7 19	350·0	365	14,514·5	726·06
Mifanwy	A. and J. O'Donnell, Hawera	6 277	350·0	365	10,872·9	663·50
Golden Fernleaf	C. Stevens, Maungatapere	7 299	350·0	365	11,130·4	652·22
Whenuku Bell Bird	T. M. Remington, Westmere	6 334	350·0	365	12,166·5	652·07
Richwood Snow Pet	G. R. and H. Hutchinson, Auckland	6 2	350·0	365	10,160·4	617·67
Sweet Lucy Grey	K. M. Stevens, Maungatapere	6 231	350·0	365	12,839·2	601·82
Golden Wonder	C. Stevens, Maungatapere	6 24	350·0	365	11,717·2	597·02
Glendernal's Dolce	Mrs. M. A. Gadsby, Stratford	9 3	350·0	357	9,583·4	562·75
Queen Patritia	C. Stevens, Maungatapere	7 363	350·0	365	9,939·1	555·73
Stromna's Buttercup	G. Hodgson, Whakapara	6 73	350·0	346	8,899·4	548·13
Almadale Queen	W. H. Miers, Rukuhia	5 295	350·0	365	9,335·3	541·50
Glenmore Flower	A. C. Lovelock, Woodville	5 35	350·0	349	9,747·2	539·25
Mercedes Noble Lady	A. C. Lovelock, Woodville	6 346	350·0	365	8,310·3	536·73
Glory's Pride	J. S. T. Short, Hawera	7 353	350·0	365	11,183·4	536·35
Rewa Ixia	A. Hazelton, Waihou	7 253	350·0	360	10,258·4	515·07
Cambridge Ne Plus Ultra	B. E. Veale, Tirohia	7 42	350·0	364	8,423·2	512·30
Roslyn Genoa Flower	A. J. Harris, Bombay	6 8	350·0	354	9,010·8	504·23
Munster	F. J. Wyatt, Towai	7 325	350·0	365	7,109·1	484·34
Liryclear Lassie	G. Milligan, Hastings	9 33	350·0	365	8,257·0	474·05
Stromna's Blossom	G. Hodgson, Whakapara	5 101	350·0	360	7,485·4	467·29

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS—*continued.*				
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Grafton Peppercorn..	A. A. White, Auckland	5 360	350·0	335	10,335·7	467·01
Mermaid's Lark ..	S. R. Lancaster, Palmerston North	10 312	350·0	354	8,819·2	466·74
Eunice of Bulls ..	J. H. Sherrard, Otaua	5 231	350·0	353	9,363·9	453·38
Royal Jenny ..	A. C. Lovelock, Woodville	5 255	350·0	306	8,773·8	447·30
Flair	J. S. Rae, Taneatua ..	5 348	350·0	365	8,881·4	442·01
Patty	G. E. Cowling, Manaia	13 149	350·0	365	7,532·3	402·77
Richwood Snow Lass	W. H. Fitness, Rehia..	6 114	350·0	283	8,447·6	396·97
Maxim Maid's Glory	F. J. Wyatt, Towai ..	8 7	350·0	360	8,035·8	389·74
Golden Swan's Gem	W. Bullock, Buckland	7 250	350·0	364	8,534·7	383·43
Jacob Irene ..	K. M. Stevens, Maungatapere	8 312	350·0	242	6,664·0	381·90
Tyrone	A. A. White, Auckland	8 92	350·0	319	6,476·0	381·39
Sweet Irene ..	C. Stevens, Maungatapere	11 271	350·0	365	6,858·3	378·30
		FRIESIANS.				
Junior Two-year-old.						
Bainfield Topsy 12th	W. D. Hunt, Waikiwi	2 34	243·9	365	15,110·5	651·38
Princess Johanna Mercedes	J. Court, Auckland ..	2 64	246·9	365	18,897·1	594·83
Nepian Lady Burton de Kol	T. Henderson, Okaiawa	2 12	241·7	365	12,586·6	548·06
May Egmont de Kol	J. Stables, Riverlea ..	2 44	244·9	365	13,552·2	513·08
May Pontiac Mooie ..	J. Court, Auckland ..	2 68	247·3	365	15,695·6	505·10
Cluny Pietje Lulu ..	Piri Land Company, Auckland	2 145	255·0	365	11,581·3	437·79
Oaklea Julip Pietertje	N. P. Nielson, Tiakitahuna	1 353	240·5	359	12,357·5	394·79
Ashlynn 139th ..	Piri Land Company, Auckland	2 37	244·2	339	9,243·0	354·70
Clevedon Princess Kroons 11	N. P. Neilsen, Tiakitahuna	1 326	240·5	365	11,210·8	335·92
May Mischief Alcartra	S. Andrew, Kaikoura	2 5	241·0	310	8,325·3	312·57
Rosebud Alcartra Beets	W. H. Madill, Auckland	1 339	240·5	287	7,812·1	303·19
Senior Two-year-old.						
Westmere Anna Patch	A. Burgess, Rongotea	2 264	266·9	365	16,948·4	510·45
Ryvington Thorn ..	T. O. Hodgson, Tamahere	2 349	275·4	365	11,173·2	442·99
Junior Three-year-old.						
Mary Alcartra ..	S. Andrew, Kaikoura	3 31	280·1	365	14,893·9	477·84
Fencourt Pet ..	J. H. Jamieson, Cambridge	3 8	277·8	365	10,237·1	311·07
Clevedon Dorothy ..	P. F. Boucher, Kumeu	3 91	286·1	292	7,294·7	290·25
Senior Three-year-old.						
Regina Sadie de Kol	J. McAnulty, Ashburton	3 349	311·9	365	18,274·4	688·24
Ashlynn 47th ..	Piri Land Company, Auckland	3 354	312·4	365	13,019·6	510·47

28—Ag. Journal.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS—*continued.*						
Senior Three-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Carlowrie Lady ..	R. K. Macdonald, Edendale	3 336	310·6	365	14,055·0	476·82
Junior Four-year-old.						
Daisy Bell 3rd ..	R. Wylie, Seaward Downs	4 22	315·7	287	13,564·0	444·13
Ashlynn 24th ..	Piri Land Company, Auckland	4 15 ..	315·0	320	12,820·3	439·65
Senior Four-year-old.						
Marchioness o'Gowrie	T. Henderson, Okaiawa	4 333	346·8	365	25,463·4	852·85
Dominion Corona ..	R. A. Cameron, Paraparaumu	4 255	339·0	365	18,263·1	611·35
Woodcrest Inka Pietje	G. A. Marchant and Sons, Cardiff	4 240	337·5	365	13,861·5	496·25
Mature.						
Westmere Netherland Princess	W. D. Hunt, Waikiwi	5 32	350·0	365	23,758·0	878·61
Princess Gem ..	James Hart, Tatuanui	7 363	350·0	365	23,455·2	794·84
Riverdale Snowflake	E. F. Peacocke, Hamilton	7 280	350·0	365	18,145·5	628·88
Weston Lea Fancy de Kol	E. F. Peacocke, Hamilton	5 46	350·0	365	15,293·0	609·42
Alcartra Galatea's Rose	Marchant and Sons, Cardiff	9 3	350·0	365	13,885·1	519·77
Clevedon Pearl ..	P. F. Boucher, Kumeu	7 163	350·0	365	13,170·9	443·69
Queen Tirania Segis	P. F. Boucher, Kumeu	7 200	350·0	288	11,683·0	400·95
MILKING SHORTHORNS.						
Mature.						
Newstead Lucy ..	E. Ridgley, Waiuku ..	..	350·0	365	16,116·8	631·02
Sinai Riri	Ranstead Bros., Matangi	..	350·0	365	13,458·3	551·26
Sinai Rangi ..	Ranstead Bros., Matangi	..	350·0	342	10·531·6	439·05
Daisy 3rd	R. Peach, Ashley Bank	..	350·0	305	10·064·9	436·60
Hamilton Pansy ..	Ranstead Bros., Matangi	..	350·0	353	9,254·2	408·41
Tainui Violet ..	Ranstead Bros., Matangi	..	350·0	365	9,820·1	390·98
Glenbank Ruby ..	A. D. Bell, Clevedon	..	350·0	365	9,765·2	387·73
AYRSHIRES.						
Two-year-old.						
Dimple of Edendale..	W. Hall, Lepperton ..	2 327	273·2	365	13,063·3	529·46
Four-year-old.						
Eliza B of Ayrshire Downs	Litchfield Bros., Tirau	4 339	347·4	365	10,633·8	486·05
Mature.						
Bertha of Ayrshire Downs	Litchfield Bros., Tirau	5 17	350·0	365	13,330·6	584·76
Generosity of Woodlands	Robertson and Blackley, New Plymouth	5 290	350·0	361	11,764·6	552·68

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

Second-class Certificates.

JERSEYS.

		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Lady Twylish of Rosy Creek	A. and J. O'Donnell, Hawera	2 7	241·2	365	10,506·5	528·13
Holly Oak Bo-Peep	M. V. Reeve-Smith, Aria	2 11	241·6	365	8,955·3	483·26
Te Matai Ruby ..	H. J. Lancaster, Levin	1 294	240·5	365	7,112·5	350·95
Three-year-old.						
Perfecta	R. L. Tippler, Shannon	3 334	310·4	365	11,709·8	551·26
Four-year-old.						
Maria Louisa ..	F. J. B. Ryburn, Pate-rangi	4 344	347·9	365	12,115·3	623·80

THE SEASON'S LAMBING: DOMINION ESTIMATES.

FOLLOWING are complete estimates of the current season's lambing, computed from estimated average percentages furnished by the Department's Inspectors of Stock in the various districts. Corresponding figures for the three previous years, together with the actual numbers of lambs tailed, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1923 ..	7,170,154	91·34	6,549,143	..
1922 ..	6,771,482	90·36	6,118,530	5,955,081
1921 ..	6,312,456	89·65	5,659,355	5,457,643
1920 ..	5,838,704	87·95	5,135,524	5,074,751
		SOUTH ISLAND.		
1923 ..	5,892,849	83·99	4,949,313	..
1922 ..	5,724,572	82·53	4,724,475	4,949,440
1921 ..	5,835,332	83·28	4,859,425	4,810,258
1920 ..	5,729,845	80·20	4,595,426	4,539,797
		DOMINION.		
1923 ..	13,063,003	88·02	11,498,456	..
1922 ..	12,496,054	86·77	10,843,005	10,895,521
1921 ..	12,147,788	86·59	10,518,780	10,267,910
1920 ..	11,568,549	84·11	9,730,950	9,614,548

A READY-RECKONER FOR WEIGHT OF FIELD CROPS PER ACRE.

C. H. SCHWASS, Fields Division, Wellington.

FOR several seasons past the writer has been associated in the work connected with the judging of farmers' field competitions and boys' and girls' agricultural club plots in Taranaki and other centres on the west coast of the North Island. Articles relating to this work have from time to time appeared in the *Journal*, and readers will have a good knowledge of what it comprises.

When the root crops are judged points are awarded for quality, cultivation, and weight, and in connection with boys' and girls' club plots for records also. The points for weight are arrived at by allowing a certain number per ton per acre. In determining the weight per acre the field or plot to be judged is carefully inspected, two or more average areas selected, and the produce of these areas weighed; from these weights the average for that particular sized area is arrived at, and the yield per acre is calculated from it. The measurements of the areas weighed are not always the same. When the crop has been sown broadcast or sown in narrow drills the area dealt with is generally 11 ft. square, while if the crop is in wide drills the area is two or more rows $\frac{1}{2}$ chain long. If the crop is in 22 in. drills the area of ground covered by one row 1 chain long is equivalent to an area 11 ft. square, and both are $\frac{1}{360}$ of an acre. In all drills of other widths the ground covered by a row 1 chain long is a different proportion of an acre, and the weights per acre are, of course, calculated accordingly.

It may be mentioned that all the root crops—both mangolds and carrots—grown by the boys' and girls' clubs on the west coast of the North Island have been grown in 22 in. drills.

It is admitted that this method of weighing crops does not give the strictly exact weight per acre, owing to variations in the crop, although such variations are, of course, taken into consideration when selecting areas. For all practical purposes, however, it is accurate enough, and is the only quick method of arriving at the yield. It operates alike for all competitors in the competitions and gives general satisfaction.

Calculating the weights under the conditions pertaining in the field was found very arduous, and the writer endeavoured to obtain a ready-reckoner, but without success, and so was compelled to compile one for himself. The formulas for arriving at the weights per acre off the different sized areas have been supplied to large numbers of inquirers who wished to weigh their crops for their own information, and it is in the hope that the ready-reckoner may prove of wider use that the following representative table is now published. Similar tables covering other units of area or width of drills may be printed n a future issue of the *Journal*.

TABLE SHOWING WEIGHT OF CROP PER ACRE WHEN THE AREA FROM WHICH THE PRODUCE IS TAKEN IS 11 FT. SQUARE OR 1 CHAIN IN 22 IN. DRILLS—EQUIVATENT TO $\frac{1}{360}$ ACRE.

Weight per Area.	Weight per Acre.				Weight per Area.	Weight per Acre.				Weight per Area.	Weight per Acre.				Weight per Area.	Weight per Acre.			
lb.	Tons	cwt.	qr.	lb.	lb.	Tons	cwt.	qr.	lb.	lb.	Tons	cwt.	qr.	lb.	lb.	Tons	cwt.	qr.	lb.
1	0	3	0	24	76	12	4	1	4	151	24	5	1	12	226	36	6	1	20
2	0	6	1	20	77	12	7	2	0	152	24	8	2	8	227	36	9	2	16
3	0	9	2	16	78	12	10	2	24	153	24	11	3	4	228	36	12	3	12
4	0	12	3	12	79	12	13	3	20	154	24	15	0	0	229	36	16	0	8
5	0	16	0	8	80	12	17	0	16	155	24	18	0	24	230	36	19	1	4
6	0	19	1	4	81	13	0	1	12	156	25	1	1	20	231	37	2	2	0
7	1	2	2	0	82	13	3	2	8	157	25	4	2	16	232	37	5	2	24
8	1	5	2	24	83	13	6	3	4	158	25	7	3	12	233	37	8	3	20
9	1	8	3	20	84	13	10	0	0	159	25	11	0	8	234	37	12	0	16
10	1	12	0	16	85	13	13	0	24	160	25	14	1	4	235	37	15	1	12
11	1	15	1	12	86	13	16	1	20	161	25	17	2	0	236	37	18	2	8
12	1	18	2	8	87	13	19	2	16	162	26	0	2	24	237	38	1	3	4
13	2	1	3	4	88	14	2	3	12	163	26	3	3	20	238	38	5	0	0
14	2	5	0	0	89	14	6	0	8	164	26	7	0	16	239	38	8	0	24
15	2	8	0	24	90	14	9	1	4	165	26	10	1	12	240	38	11	1	20
16	2	11	1	20	91	14	12	2	0	166	26	13	2	8	241	38	14	2	16
17	2	14	2	16	92	14	15	2	24	167	26	16	3	4	242	38	17	3	12
18	2	17	3	12	93	14	18	3	20	168	27	0	0	0	243	39	1	0	8
19	3	1	0	8	94	15	2	0	16	169	27	3	0	24	244	39	4	1	4
20	3	4	1	4	95	15	5	1	12	170	27	6	1	20	245	39	7	2	0
21	3	7	2	0	96	15	8	2	8	171	27	9	2	16	246	39	10	2	24
22	3	10	2	24	97	15	11	3	4	172	27	12	3	12	247	39	13	3	20
23	3	13	3	20	98	15	15	0	0	173	27	16	0	8	248	39	17	0	16
24	3	17	0	16	99	15	18	0	24	174	27	19	1	4	249	40	0	1	12
25	4	0	1	12	100	16	1	1	20	175	28	2	2	0	250	40	3	2	8
26	4	3	2	8	101	16	4	2	16	176	28	5	2	24	251	40	6	3	4
27	4	6	3	4	102	16	7	3	12	177	28	8	3	20	252	40	10	0	0
28	4	10	0	0	103	16	11	0	8	178	28	12	0	16	253	40	13	0	24
29	4	13	0	24	104	16	14	1	4	179	28	15	1	12	254	40	16	1	20
30	4	16	1	20	105	16	17	2	0	180	28	18	2	8	255	40	19	2	16
31	4	19	2	16	106	17	0	2	24	181	29	1	3	4	256	41	2	3	12
32	5	2	3	12	107	17	3	3	20	182	29	5	0	0	257	41	6	0	8
33	5	6	0	8	108	17	7	0	16	183	29	8	0	24	258	41	9	1	4
34	5	9	1	4	109	17	10	1	12	184	29	11	1	20	259	41	12	2	0
35	5	12	2	0	110	17	13	2	8	185	29	14	2	16	260	41	15	2	24
36	5	15	2	24	111	17	16	3	4	186	29	17	3	12	261	41	18	3	20
37	5	18	3	20	112	18	0	0	0	187	30	1	0	8	262	42	2	0	16
38	6	2	0	16	113	18	3	0	24	188	30	4	1	4	263	42	5	1	12
39	6	5	1	12	114	18	6	1	20	189	30	7	2	0	264	42	8	2	8
40	6	8	2	8	115	18	9	2	16	190	30	10	2	24	265	42	11	3	4
41	6	11	3	4	116	18	12	3	12	191	30	13	3	20	266	42	15	0	0
42	6	15	0	0	117	18	16	0	8	192	30	17	0	16	267	42	18	0	24
43	6	18	0	24	118	18	19	1	4	193	31	0	1	12	268	43	1	1	20
44	7	1	1	20	119	19	2	2	0	194	31	3	2	8	269	43	4	2	16
45	7	4	2	16	120	19	5	2	24	195	31	6	3	4	270	43	7	3	12
46	7	7	3	12	121	19	8	3	20	196	31	10	0	0	271	43	11	0	8
47	7	11	0	8	122	19	12	0	16	197	31	13	0	24	272	43	14	1	4
48	7	14	1	4	123	19	15	1	12	198	31	16	1	20	273	43	17	2	0
49	7	17	2	0	124	19	18	2	8	199	31	19	2	16	274	44	0	2	24
50	8	0	2	24	125	20	1	3	4	200	32	2	3	12	275	44	3	3	20
51	8	3	3	20	126	20	5	0	0	201	32	6	0	8	276	44	7	0	16
52	8	7	0	16	127	20	8	0	24	202	32	9	1	4	277	44	10	1	12
53	8	10	1	12	128	20	11	1	20	203	32	12	2	0	278	44	13	2	8
54	8	13	2	8	129	20	14	2	16	204	32	15	2	24	279	44	16	3	4
55	8	16	3	4	130	20	17	3	12	205	32	18	3	20	280	45	0	0	0
56	9	0	0	0	131	21	1	0	8	206	33	2	0	16	281	45	3	0	24
57	9	3	0	24	132	21	4	1	4	207	33	5	1	12	282	45	6	1	20
58	9	6	1	20	133	21	7	2	0	208	33	8	2	8	283	45	9	2	16
59	9	9	2	16	134	21	10	2	24	209	33	11	3	4	284	45	12	3	12
60	9	12	3	12	135	21	13	3	20	210	33	15	0	0	285	45	16	0	8
61	9	16	0	8	136	21	17	0	16	211	33	18	0	24	286	45	19	1	4
62	9	19	1	4	137	22	0	1	12	212	34	1	1	20	287	46	2	2	0
63	10	2	2	0	138	22	3	2	8	213	34	4	2	16	288	46	5	2	24
64	10	5	2	24	139	22	6	3	4	214	34	7	3	12	289	46	8	3	20
65	10	8	3	20	140	22	10	0	0	215	34	11	0	8	290	46	12	0	16
66	10	12	0	16	141	22	13	0	24	216	34	14	1	4	291	46	15	1	12
67	10	15	1	12	142	22	16	1	20	217	34	17	2	0	292	46	18	2	8
68	10	18	2	8	143	22	19	2	16	218	35	0	2	24	293	47	1	3	4
69	11	1	3	4	144	23	2	3	12	219	35	3	3	20	294	47	5	0	0
70	11	5	0	0	145	23	6	0	8	220	35	7	0	16	295	47	8	0	24
71	11	8	0	24	146	23	9	1	4	221	35	10	1	12	296	47	11	1	20
72	11	11	1	20	147	23	12	2	0	222	35	13	2	8	297	47	14	2	16
73	11	14	2	16	148	23	15	2	24	223	35	16	3	4	298	47	17	3	12
74	11	17	3	12	149	23	18	3	20	224	36	0	0	0	299	48	1	0	8
75	12	1	0	8	150	24	2	0	16	225	36	3	0	24	300	48	4	1	4

TABLE SHOWING WEIGHT OF CROP PER ACRE—*continued.*

Weight per Area.	Weight per Acre.				Weight per Area.	Weight per Acre.				Weight per Area.	Weight per Acre.				Weight per Area.	Weight per Acre.			
lb.	Tons	cwt.	qr.	lb.	lb.	Tons	cwt.	qr.	lb.	lb.	Tons	cwt.	qr.	lb.	lb.	Tons	cwt.	qr.	lb.
301	48	7	2	0	384	61	14	1	4	467	75	1	0	8	549	88	4	2	16
302	48	10	2	24	385	61	17	2	0	468	75	4	1	4	550	88	7	3	12
303	48	13	3	20	386	62	0	2	24	469	75	7	2	0	551	88	11	0	8
304	48	17	0	16	387	62	3	3	20	470	75	10	2	24	552	88	14	1	4
305	49	0	1	12	388	62	7	0	16	471	75	13	2	20	553	88	17	2	0
306	49	3	2	8	389	62	10	1	12	472	75	17	0	16	554	89	0	2	24
307	49	6	3	4	390	62	13	2	8	473	76	0	1	12	555	89	3	3	20
308	49	10	0	0	391	62	16	3	4	474	76	3	2	8	556	89	7	0	16
309	49	13	0	24	392	63	0	0	0	475	76	6	3	4	557	89	10	1	12
310	49	16	1	20	393	63	3	0	24	476	76	10	0	0	558	89	13	2	8
311	49	19	2	16	394	63	6	1	20	477	76	10	0	24	559	89	16	3	4
312	50	2	3	12	395	63	9	2	16	478	76	16	1	20	560	90	0	0	0
313	50	6	0	8	396	63	12	3	12	479	76	19	2	16	561	90	3	0	24
314	50	9	1	4	397	63	16	0	8	480	77	2	2	12	562	90	6	1	20
315	50	12	2	0	398	63	19	1	4	481	77	6	0	8	563	90	9	2	16
316	50	15	2	24	399	64	2	2	0	482	77	9	1	4	564	90	12	3	12
317	50	18	3	20	400	64	5	2	24	483	77	12	2	0	565	90	16	0	8
318	51	2	0	16	401	64	8	3	20	484	77	15	2	24	566	90	19	1	4
319	51	5	1	12	402	64	12	0	16	485	77	18	3	20	567	91	2	2	0
320	51	8	2	8	403	64	15	1	12	486	78	2	0	16	568	91	5	2	24
321	51	11	3	4	404	64	18	2	8	487	78	5	1	12	569	91	8	3	20
322	51	15	0	0	405	65	1	3	4	488	78	8	2	8	570	91	12	0	16
323	51	18	0	24	406	65	5	0	0	489	78	11	3	4	571	91	15	1	12
324	52	1	1	20	407	65	8	0	24	490	78	15	0	0	572	91	18	2	8
325	52	4	2	16	408	65	11	1	20	491	78	18	0	24	573	92	1	3	4
326	52	7	3	12	409	65	14	2	16	492	79	1	1	20	574	92	5	0	0
327	52	11	0	8	410	65	17	3	12	493	79	4	2	16	575	92	8	0	24
328	52	14	1	4	411	66	1	0	8	494	79	7	3	12	576	92	11	1	20
329	52	17	2	0	412	66	4	1	4	495	79	11	0	8	577	92	14	2	16
330	53	0	2	24	413	66	7	2	0	496	79	14	1	4	578	92	17	3	12
331	53	3	3	20	414	66	10	2	24	497	79	17	2	0	579	93	1	0	8
332	53	7	0	16	415	66	13	3	20	498	80	0	2	24	580	93	4	1	4
333	53	10	1	12	416	66	17	0	16	499	80	3	3	20	581	93	7	2	0
334	53	13	2	8	417	67	0	1	12	500	80	7	0	16	582	93	10	2	24
335	53	16	3	4	418	67	3	2	8	501	80	10	1	12	583	93	13	3	20
336	54	0	0	0	419	67	6	3	4	502	80	13	2	8	584	93	17	0	16
337	54	3	0	24	420	67	10	0	0	503	80	16	3	4	585	94	0	1	12
338	54	6	1	20	421	67	13	0	24	504	81	0	0	0	586	94	3	2	8
339	54	9	2	16	422	67	16	1	20	505	81	3	0	24	587	94	6	3	4
340	54	12	3	12	423	67	19	2	16	506	81	6	1	20	588	94	10	0	0
341	54	16	0	8	424	68	2	2	12	507	81	9	2	16	589	94	13	0	24
342	54	19	1	4	425	68	6	0	8	508	81	12	3	12	590	94	16	1	20
343	55	2	2	0	426	68	9	1	4	509	81	16	0	8	591	94	19	2	16
344	55	5	2	24	427	68	12	2	0	510	81	19	1	4	592	95	2	3	12
345	55	8	3	20	428	68	15	2	24	511	82	2	2	0	593	95	6	0	8
346	55	12	0	16	429	68	18	3	20	512	82	5	2	24	594	95	9	1	4
347	55	15	1	12	430	69	2	0	16	513	82	8	3	20	595	95	12	2	0
348	55	18	2	8	431	69	5	1	12	514	82	12	0	16	596	95	15	2	24
349	56	1	3	4	432	69	8	2	8	515	82	15	1	12	597	95	18	3	20
350	56	5	0	0	433	69	11	3	4	516	82	18	2	8	598	96	2	0	16
351	56	8	0	24	434	69	15	0	0	517	83	1	3	4	599	96	5	1	12
352	56	11	1	20	435	69	18	0	24	518	83	5	0	0	600	96	8	2	8
353	56	14	2	16	436	70	1	1	20	519	83	8	0	24	601	96	11	3	4
354	56	17	3	12	437	70	4	2	16	520	83	11	1	20	602	96	15	0	0
355	57	1	0	8	438	70	7	3	12	521	83	14	2	16	603	96	18	0	24
356	57	4	1	4	439	70	11	0	8	522	83	17	3	12	604	97	1	1	0
357	57	7	2	0	440	70	14	1	4	523	84	1	0	8	605	97	4	2	16
358	57	10	2	24	441	70	17	2	0	524	84	4	1	4	606	97	7	3	12
359	57	13	3	20	442	71	0	2	24	525	84	7	2	0	607	97	11	0	8
360	57	17	0	16	443	71	3	3	20	526	84	10	2	24	608	97	14	1	4
361	58	0	1	12	444	71	7	0	16	527	84	13	3	20	609	97	17	2	0
362	58	3	2	8	445	71	10	1	12	528	84	17	0	16	610	98	0	2	24
363	58	6	3	4	446	71	13	2	8	529	85	1	0	12	611	98	3	3	20
364	58	10	0	0	447	71	16	3	4	530	85	3	2	8	612	98	7	0	16
365	58	13	0	24	448	72	0	0	0	531	85	6	3	4	613	98	10	1	12
366	58	16	1	20	449	72	3	0	24	532	85	10	0	0	614	98	13	2	8
367	58	19	2	16	450	72	6	1	20	533	85	13	0	24	615	98	16	3	4
368	59	2	3	12	451	72	9	2	16	534	85	16	1	20	616	99	0	0	0
369	59	6	0	8	452	72	12	3	12	535	85	19	2	16	617	99	3	0	24
370	59	9	1	4	453	72	16	0	8	536	86	2	3	12	618	99	6	1	20
371	59	12	2	0	454	72	19	1	4	537	86	6	0	8	619	99	9	2	16
372	59	15	2	24	455	73	2	2	0	538	86	9	1	4	620	99	12	3	12
373	59	18	3	20	456	73	5	2	24	539	86	12	2	0	621	99	16	0	8
374	60	2	0	16	457	73	8	3	20	540	86	15	2	24	622	99	19	1	4
375	60	5	1	12	458	73	12	0	16	541	86	18	3	20	623	100	2	2	0
376	60	8	2	8	459	73	15	1	12	542	87	2	0	16	624	100	5	2	24
377	60	11	3	4	460	73	18	2	8	543	87	5	1	12	625	100	8	3	20
378	60	15	0	0	461	74	1	3	4	544	87	8	2	8	626	100	12	0	16
379	60	18	0	24	462	74	5	0	0	545	87	11	3	4	627	100	15	1	12
380	61	1	1	20	463	74	8	0	24	546	87	15	0	0	628	100	18	2	8
381	61	4	2	16	464	74	11	1	20	547	87	18	0	24	629	101	1	3	4
382	61	7	3	12	465	74	14	[illegible]	16	548	88	[illegible]	[illegible]	[illegible]					

SEASONAL NOTES.

THE FARM.

SUMMER DAIRYING.

JANUARY is now approaching, and with it the most critical period in the dairy-farmer's calendar. December sees most of the grasses reach maturity, and with normal summer weather the period following shows a marked decline in the production of the pastures. This coincides with and tends to encourage the natural tendency of the cows to dry off, or, at any rate, to seriously curtail their milk-yield, and a good supply of succulent food coming forward as the pastures decline will make all the difference in butterfat-production. Japanese millet and early-sown soft turnips provide very useful January feeding. The millet can subsequently be shut up for further feeding, and land that has grown turnips be prepared for an early sowing of grass. Ensilage, too, acts as an excellent brake on the downward trend of production. An ensilage pit or stack can, in fact, be brought into use at any time of the year when most needed.

CEREAL HARVEST.

The dryness and warmth of the early summer this year has hastened the ripening of grain crops, and the harvesting of oats will now have commenced. It is always advisable to cut oats before they become too ripe. Inexperienced farmers are apt to allow their crops to become dead-ripe before cutting, with the result that there is loss of grain and deterioration in quality of straw.

The weather in January is often tricky, and it is advisable to have all grain stooked as soon as cut. The stooks should not be large, from ten to fourteen sheaves being sufficient. These should be put up as firmly as possible so that they will stand heavy wind. It should also be remembered that well-built stooks will turn a lot of rain, while if they are carelessly made and go down, considerable damage may result in loss of colour in the grain.

The round stack is generally best for North Island conditions. These stacks should be made a handy size, so that one or more may be finished in a day, according to the team employed.

The wheat harvest will generally follow oats in Canterbury and other grain-growing districts. It is usually necessary to leave the wheat in stook at least a fortnight before carting in. From the quantity of badly-conditioned wheat submitted for sale one must stress the importance of putting wheat into stack before threshing. Circumstances of one kind or another often lead a farmer to thresh out of stook, and sometimes in moist weather. This seriously militates against the obtaining of a first-grade sample, and it is very difficult for such wheat to come into condition. Wheat in stack should not be threshed for at least five or six weeks, and preferably longer, as sweating takes place in the stack and the process extends over several weeks. Owing to the possible shortage of wheat this year there will be a danger of farmers assuming a "that will do" attitude, and a hint will not be out of place.

With the greater need nowadays for pure seed-wheat it behoves growers to secure a clean line of seed, and save their own seed for succeeding years. This will necessitate roguing a few acres and threshing it separately. Roguing, which is the removal of foreign varieties from the crop grown, can best be done just before harvest. Two or three men moving through the standing crop in narrow parallel strips a week or two before harvest will be able to recognize any rogues. These should be pulled out by the roots and not merely picked off, as the short later heads might be missed.

ROOT CROPS.

The sowing of root crops is generally completed by Christmas, but in the higher districts swedes may be sown up till the middle of January. After this it is safer to try turnips, and for this purpose Hardy or Imperial Green Globe

will be found among the best. The sowing should be heavier than in the spring, as germination will probably not be so good—from 14 oz. to 16 oz. being about the right amount. Except in wet localities, the results from sowing on the flat as against the ridge will be better during the dry period, and the land should be well rolled before sowing, so as to ensure a supply of moisture from the subsoil. The dipping of seed in turpentine as a preventive of insect attack in the seedling stage, although often suggested, does not appear to be of very much value, but definite experimental work in this direction is lacking.

In ridged areas the early-sown crops should be thinned either by hand or machine. The thinning of turnips of late years has been somewhat overlooked in most districts, but where carried out it has been found a sound practice.

FEEDING OF RAPE AND TURNIPS.

Early-sown rape should be ready toward the end of January, but care must be taken not to stock this crop until it is in a good condition for feeding. This is when the leaves turn a bluish colour, it then having its highest feeding-value. If the crop is badly infested with aphis or moth the better plan is to feed it off at once, thus destroying the breeding-ground for the insects, with the hope that the second crop will be clean. The same remarks apply to the swede crop if this is being badly attacked and likely to be ruined. It is then good practice to put some sheep or lambs on to eat off the tops quickly and starve out the pests, trusting to a new growth to develop the roots.

Turnip-feeding to dairy cows still arouses much controversy and sometimes no little heartburning. The best plan for the dairy-farmer is not to treat turnips as a grazing-crop at all—at any rate, while the cows are still in milk. The aim should be to secure a supply of good-sized roots from a comparatively small and well-worked area ; carting-off is not then the laborious work it is apt to be when the bulbs are small and the area large. From 30 lb. to 40 lb. per day per cow is reasonably safe if the roots are fed at the proper time.

THE HAY CROP.

The hay crop has been earlier than usual this year in most districts, but in the later localities there will still be a good deal to save. If the weather is showery the crop should be allowed to remain in the swath until there is a prospect of a fine day or two to save it. It is wonderful how long hay will remain good in the swath if not disturbed, but once it is shaken up it deteriorates rapidly if not put into stack. It is always advisable to add salt to hay ; about 10 lb. per ton is generally sufficient, but the poorer the material the more salt is required.

Extra care in stacking will be amply repaid by the saving in waste. Aim to build high, so that the roof area will be proportionately small and pressure good. A flat top will also be avoided should the supply of material fail to come up to expectations.

Paspalum is now making strong growth in the North Auckland districts, and where it tends to get ahead of the stock it should be cut for ensilage or hay. The subsequent growth also will be more succulent and palatable.

CULTIVATION.

This is the all-important time of the year, especially under Canterbury conditions, for cleaning twitch-infested lands. Where the plough can be used to advantage it is the most effective implement. If the grubber is used it must be worked almost incessantly during the dry weather, as small pieces of twitch left in partly consolidated land will soon infest the area again. Where it is desired to clean up land badly infected with weeds generally the ground should be ploughed as early as possible and given frequent workings to destroy the roots.

January is a good time for preparing land intended for winter or early spring green crops.

—*Fields Division.*

SHEEP-DIPPING.

It is in the interest of every sheepowner to ensure that his flocks are efficiently dipped—that is, dipped so that the sheep will remain clean until the following shearing. In order to obtain satisfactory results it is necessary to use

a poisonous dip. Great care should be taken to follow out the instructions on the packet or drum, as probably half the failures in dipping are due to owners neglecting to carry out the manufacturers' instructions.

One of the most common causes of failure is insufficient immersion. Each sheep should be held for at least one minute in the bath. This is absolutely necessary to obtain effective results. Another cause of failure is dipping in a dirty bath. Nothing reduces the strength of a dip like filth, which also seriously affects the character of the wool. The bath should be cleaned out at intervals. It is impossible to lay down a hard-and-fast rule regarding the number of sheep passing through the bath before it requires cleaning, as this depends entirely on the condition of the animals. It only requires a limited number of sheep that have been travelled long distances, railed, or shipped to make the bath filthy.

A serious mistake that has come under notice is the making-up of a dip three parts poisonous and one part non-poisonous. These two classes of dip are composed of different constituents, and the one does not increase the strength of the other. A dip so constituted could be classed only as of 75-per-cent. strength, and, without doubt, the condition of numbers of tick- or lice-infested sheep is due to this cause. The poisonous dip should be made full strength, with 25 per cent. liquid carbolic dip added. This is especially beneficial where the water is hard. Water can also be softened by the addition of about 3 lb. of washing-soda to every 100 gallons of water, or soap may be added until the water lathers on stirring.

The following rules should be strictly observed in dipping: (1) Avoid dipping in wet weather; (2) measure accurately the bath-water; (3) dissolve thoroughly powder dip before using; (4) mix the dip properly; (5) thoroughly stir the bath; (6) immerse sheep for at least one minute; (7) use the dip full strength; (8) never dip in a dirty bath; (9) if sheep are affected with lice, dip again in a fortnight's interval, as the eggs will hatch in about ten days. On no account should a dog that is inclined to heel the sheep be allowed in the yards when dipping, as this is one of the chief causes of blood-poisoning.

—*Live-stock Division.*

THE ORCHARD.

STONE-FRUITS.

THE period of stone-fruit harvest will soon be at peak, and marketing of the crop in the best possible condition should be the aim. This can be done only by careful selection at picking-time. Once the fruits have attained size for the variety, close watch should be kept for signs of ripeness. Ripeness from the orchardist's point of view is rather different from the ripe condition expected by the consumer. Ripeness for the grower is when the fruit has attained that degree of advancement beyond which it would commence to become soft-ripe. On the judgment shown by the picker in selecting fruit which is mature but not soft often depends the difference between profit and loss.

It is very rare for all the fruits on any tree to be found in condition in less than three pickings, while it is astonishing to the uninitiated what development takes place in the smaller fruits which are left on the tree at first picking. Observation discloses that a large proportion of the overripe peaches and nectarines come from the inner part of the tree. Fruits exposed on the outer parts naturally colour up better and are more readily seen; those in the sheltered parts very rarely take on colour to indicate ripeness, yet, once they have attained size, ripening takes place even more rapidly than with exposed fruits. Close attention should therefore be given to fruit grown on the inner parts of the trees if loss due to overripeness is to be eliminated.

Careful grading as to size and quality also assists towards presenting the fruit in the best condition. Fruit packed on size reduces the risk of a loose pack and shaking contents, and consequent bruising in transit; fruit of the one quality packed together also presents a better appearance.

With the risk of brown-rot appearing in a ripening crop or developing in transit every effort should be made to counteract this disease. Lime-sulphur, 1–125, plus 6 lb. of atomic sulphur, should be applied up to within, say, ten days

of picking. Though at all times there is uncertainty of control, this mixture is giving the best results of any in use at the present time. Further measures for control are the use of new cases and, above all, the prevention of skin-puncture.

After the fruit is harvested the orchardist should go over the trees, cut out any broken limbs, and daub the cut with coal-tar to prevent the entry of silver-blight. The land can then be sown down to a cover-crop. Any crop found suitable to the district is preferable to weeds, but a leguminous crop should be chosen if such can be grown.

PIP-FRUITS.

Now is the time to concentrate on getting the pip-fruit area of the orchard into the most advanced condition. If any work falls in arrear at this season it is most difficult to overtake, as picking, &c., will soon demand first consideration. Cultivation should be continued to kill weeds, and, most especially, to break the earth-crust after any shower of rain.

Seasonable pests and diseases to be prevented or controlled are codlin-moth, leaf-roller, leech (arsenate of lead, 1½ lb. to 100 gallons); powdery mildew (lime-sulphur, 1–100, or atomic sulphur, 8 lb. to 100 gallons), also pruning off all mildew-infected tips if time allows; leaf-hopper, red mite, woolly aphis (nicotine, 1 pint to 100 gallons); and black-spot (bordeaux, 3–4–40, or lime-sulphur, 1–100).

With the fruits showing signs of colour it is now more than ever necessary to avoid as far as possible the spray being deposited in drops, otherwise the colour will be spotted. The casein-spreaders are best for this purpose, causing an even diffusion of spray often desired but not attained prior to the introduction of this valuable adjunct. Casein in the crude form requires special preparation, but there are several brands of prepared material on the market. An efficient dosage is 1 lb. per 100 gallons of any spray.

There is at this period a market for the more advanced sizes of such cookers as Alfriston, Lord Suffield, Prince Alfred, &c. Some degree of immaturity is permissible thus early in the season when cookers are in strong demand, size being the main consideration. Immaturity is not permissible in marketing early dessert sorts, such as Irish Peach, Astrakhan, Quarrenden, &c.; indeed, it is to be avoided in them. Fruits arriving in immature condition usually meet with poor demand and injuriously affect the market. When a market opens slack and low it is often difficult to restore confidence or prices. That immature fruit has a depressing effect is well known to those who view the markets as a whole, but is not sufficiently recognized by those who each send a few cases, which combine to cause the effect.

ORGANIZATION.

Orchard conveyances, packing-sheds, grading-machines, and fruit-harvesting gear should now be put in order to receive the crop, cases made up, and preparations made for action generally. Special boxes should be reserved for handling the fruit in the orchard, and clean cases used in which to pack the fruit for market. When the cases are used in the orchard they often become discoloured and dirty, and bring discredit on the contents. The movement among growers for concerted action in the endeavour to improve market conditions depends for success a good deal on the individual orchardist. While the main organization can do much good, it must fail in part, if not altogether, unless supported by the grower perfecting his own orchard organization by providing proper packing facilities, materials, &c. While efforts should be made to economize by reducing marketing-costs, efficiency should be the keynote; but without forethought and organization, efficiency is interrupted. This will apply with equal force whether the channel of distribution be through a central controlling Board, merchant, or auctioneer.

—*W. H. Rice, Orchard Instructor, Hastings.*

CITRUS-CULTURE.

In groves where *Lecanium oleae* scale has not been efficiently dealt with by the early application of red-oil emulsion, 1–40, in the spring, a further application of this spray should now be made. It is very noticeable that quite a number of growers are not dealing with this pest as they should. Some growers have gone so far as to say that spraying with red-oil emulsion will not efficiently check

the spread of the scale, but I am firmly of opinion that this troublesome pest can be almost completely controlled by the careful and judicious application of the emulsion at the *correct periods.*

A citrus-tree is always a hard tree to spray in an efficient manner, as, owing to its glossy foliage, one is apt to consider that all parts of the tree have been well covered with the spray when such is not the case. In many instances too little attention is paid to the proper covering of the under-surface of the leaves, which, especially in the case of the lemon, is the chief breeding-ground of the scale. Again, a large number of growers, who for one reason or another allow their trees to grow too thickly, and in some cases allow the lower branches to drag right on to the ground, are preventing to a large degree the carrying-out of proper spraying.

If two applications of the oil are not sufficient, then a third one should be made, applied at the time best calculated to catch young scale on the move. The defoliation caused by the use of oil, of which one hears so much from some growers, is to a very large extent caused either by faulty emulsification or badly mixed sprays. No doubt also in some instances the defoliation may be traced to weakness in those particular trees.

Where the application of bordeaux, 4–4–40, has been deferred, this may yet be applied.

FIREBLIGHT.

It may now be reasonably expected that fireblight will show up in various localities at any time during this season of the year. The second infection—namely, tip-infection—may be looked for in apples at any time from now on. It is too early at the time of writing these notes to definitely state the degree of freedom or otherwise from fireblight of orchards in the Auckland District, but it is pleasing to note that up to the present time only one infection has been identified in the commercial areas. Although this is the case, it does not follow that any other district will be in such a happy position, and it is therefore necessary to maintain a strict watchfulness over all pip-fruit orchards, whether they are situated in an area where fireblight has previously been known to exist or not.

Although fireblight has been existent in New Zealand now for three years, it is possible that there may be some growers who have not yet made themselves conversant with the procedure advised to be adopted in the event of the disease being identified. The disease is easily detected at this stage, whereas later in the season—during the winter months—it is difficult, and in many cases impossible, to locate.

Control measures consist in the removal of diseased portions of infected trees. On lateral shoots cut some inches below cankers; on larger branches cut out the cankers and all discoloured tissue with a sharp knife. The wounds should then be sterilized with a corrosive-sublimate solution, and painted over with coal-tar. It is important that all instruments used—secateurs, knives, &c.—should be sterilized after each cut. This is necessary so that these instruments will not spread infection.

All severed laterals, cankered portions, &c., should be immediately burned, for if they are allowed to lie about they will be the source of further infection now and in the following spring.

For sterilizing knives, secateurs, &c., use formalin, 1 part, and water, 20 parts. Mix and keep in a convenient wide-mouthed receptacle, so that the instruments can be readily dipped in it. Quick immersion will be sufficient to kill any organism likely to be present.

For disinfecting areas on the trees that have been cut use corrosive sublimate, 1 part, and water, 1,000 parts. This equals one tabloid to 1 pint of water. Apply with a small brush. This is a *deadly poisonous* compound, and should not be left lying about. Keep it in a glass or earthenware receptacle—not in a tin—and do not dip knives or secateurs into it, as metals decompose the solution.

As a wound-covering after sterilization with corrosive sublimate use pure coal-tar. Apply with a stiff brush. It is practically harmless to the tree, and when coated on the wound prevents the entry of parasitic fungi.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CARE OF THE GROWING STOCK AND LAYERS.

Now that the work of hatching is over and the chickens have passed the brooder stage the demands on the poultry-keeper's time will not be nearly so great as formerly.

Care of the growing stock and maintaining the laying-flock in a high productive condition will necessarily claim first attention. Especially should the hens it is intended to cull next autumn be placed on a forcing diet, in order that every available egg be secured before they are disposed of. To achieve this, a good supply of forcing-material, such as boiled meat, meat-meal, or skim-milk, should be included in the ration. Of course, if these rich foods are oversupplied, ovarian troubles are apt to follow, such as protusion of the oviduct and the production of shell-less eggs, &c. If these troubles make their appearance the forcing diet should be reduced by degrees until the trouble ceases. This is not to say that the whole flock should be kept back merely because the forcing diet has had an injurious effect on an odd bird or two. Poultry-keepers must use their own discretion in this respect.

DEALING WITH BROODY HENS.

Among other things that should be attended to now is keeping the nests free from broody hens, as this condition not only means a loss in eggs but encourages the presence of vermin. The houses should be regularly visited after dark, and all broodies at once removed to the broody-coop. The latter should consist of three compartments. The first day's broodies should be placed in No. 1 compartment, the second in No. 2, and the third day's in No. 3. In a general way, if the birds are removed from the nest on the first sign of broodiness they may be liberated on the fourth day. Thus, if properly attended to, the broodies in No. 1 compartment may be set free when the fourth day's broodies are being cooped. The floor of a broody-coop should be made of slats or small-mesh wire netting; it should also be raised above ground-level on legs or bricks, &c. In this way a free draught of fresh air is provided which greatly tends to make the bird lose the desire to set. The broody hens should not be starved because they are not laying: the better the food and the attention they receive the sooner will they resume egg-production. The broody-coop should be arranged in such a way that food, clean water, and grit are available to them at all times.

INCUBATING AND BROODING EQUIPMENT.

All incubators and brooding appliances should be thoroughly cleaned and disinfected before being set aside. Lamps should be well scoured in boiling water; the brooder runs should be turned up and limed, and everything done to ensure in these a clean condition and a good growth of grass in the spring.

THE SURPLUS COCKERELS.

The stock should on no account be overcrowded; it is one of the worst and frequent mistakes made by poultry-keepers. All surplus cockerels four and a half months old and over should be marketed without delay. The table cockerel is only truly profitable when marketed before the second lot of feathers commence to develop. It is a weak policy to market a cockerel in a mere store condition. Turning such a bird into a choice table delicacy by good feeding and special care and management will not only double its weight but also the profit made by the poultry-keeper. It is useless trying to fatten cockerels unless they are free from vermin. Dust frequently with flour of sulphur and carbolic powder, in order to keep the lice in check, and also see that the quarters in which the birds are kept are maintained in a thoroughly sanitary state.

GREEN FOOD.

For success in poultry-keeping one of the principal points is to secure the greatest profit possible from the flock over the cost of production—which does not necessarily mean obtaining the greatest number of eggs. Any system of feeding, for instance, that will return a higher net profit over its cost than another is a matter that should at all times be considered. With this end in view I cannot urge too strongly the necessity of providing an adequate supply

of green material at all seasons of the year. It not only replaces to a material extent more costly foods, but, in addition, it is an essential for maintaining the birds in good health.

In anticipation of dearer wheat next year the question of providing for an ample supply of green material is a matter that should not be neglected now. Nothing is better than silver-beet; it gives a great yield per acre, and plants of the previous year's sowing—the leaves of which have been removed in the autumn—will furnish just the tender material in the spring, when the chickens in the brooder are demanding a constant supply. Cabbage, mangolds, kale, rape, &c., are also suitable for poultry.

Where lucerne is grown and there is a surplus over current requirements it should be cut and cured in a succulent stage and put by for winter use. Lucerne should be cut on a rising weather-glass, so that it may be stacked or placed under cover before it sheds its leaves or gets into an overdry, bleached condition. In the succulent stage the fowls will relish it when finely chaffed and boiled or steamed overnight. It will also have the effect of promoting egg-production. On the other hand, if it is not cut in its tender stage, and is subjected to weather conditions over a period of time, it will prove next to useless when included in the ration. Some poultry-keepers chaff the lucerne as soon as it is cut, and spread it lightly over the concrete floor of the brooder-house to dry, when the latter is not in use. Others use a galvanized-iron roof for this purpose, boards being placed around the roof to prevent the chaff from blowing away. In this way the chaff retains its properties to the fullest extent. Another advantage in chaffing lucerne green is that this is much more easily carried out than when the stuff is dry.

At this time of the year in particular there should be no stint of green food on a poultry plant. Especially does this apply to the growing stock; they cannot thrive to the best advantage without it; moreover, they can be practically half-fed upon it. During hot weather one frequently sees chickens practically refuse to eat grain material unless forced to by hunger, whereas if green-stuff is thrown to them they will simply rush it. This indicates what they require, as usually what they eat up greedily is what they need for promoting healthy development, an essential requirement for future heavy egg-production.

It is always best to feed green-stuff separately, and late in the day during hot weather. Thus if more is supplied than the birds require it will generally be found fresh enough for them the following morning. On the other hand, if fed early in the day any left over will become dried up to such an extent that the birds will not eat it, with the result that it will be wasted.

Neglect to provide the stock with a liberal supply of green food, occasionally or at all periods of the year, is a common weakness found on many unsuccessful plants.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

RETURNING SWARMS.

SWARMS in January are of little value except as increase for next season, and should be returned to the hives whence they originate if they can be traced. It is a good plan to kill the old queen in the swarm when returning it, at the same time destroying all but two queen-cells in the parent colony. If the hive is cramped an extra super may be given, and with this inducement the colony will usually settle down at once to work.

After-swarms should always be returned to the parent hive. They are easily disposed of even if the beekeeper does not know whence they came. If they are shaken through an excluder into an empty super the virgin queen or queens can easily be picked out as they attempt to force their way through, and once these are removed the bees will return to their old home. The young queens can then be used to replace poor queens in the apiary. It is an excellent plan to have one or two queen-cages always on hand. The young queens can each be confined in a separate cage, and when the queen to be destroyed is removed the closed cage containing the virgin can be placed on top of the frames and left

there for twenty-four hours, during which time she will be fed by the bees in the hive. At the end of twenty-four hours she can be released and allowed to run down into the frame, when she will be accepted by the bees.

VENTILATION.

The matter of ventilating the hives should by now be receiving every attention. Every means should be used to ensure the bees having an abundance of fresh air day and night. All weeds and other obstructions should be removed from the fronts of the hives, and the entrances enlarged as much as possible. In extreme cases the hive-bodies should be raised from the bottom-boards by means of small blocks of wood. On no account should the bees be allowed to cluster outside the hives, and, wherever they show a tendency to excessive fanning, steps should be at once taken to increase the supply of fresh air to the colonies.

SUPERS.

One of the necessities of a well-regulated apiary is an abundance of supers when the honey-flow is in full swing. Every inducement should be given the bees during the often brief season to gather in every available drop of nectar. No beekeeper with business acumen will allow his bees to loaf or cluster outside the hives for lack of storage-room. It is well, when adding additional supers, to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

It should be understood, however, th t supering must not be overdone, and the bees disheartened by being given too much work at one time. On no account add a second super until the bees are well at work on the first, and in cases where the colonies are only building up well at the beginning of the honey-flow—that is, where a poor colony has been requeened and the new queen's brood has not as yet hatched—it is an excellent plan to tier up with half-stories. Many an apiarist has had a moderate return from a small colony with half-stories, when it is doubtful if any return at all would have been obtained by the use of full-depth supers.

QUEEN-EXCLUDERS.

January is the month when queen-excluders are of most use to the beekeeper, especially in southern districts. Whatever their disadvantage may be in some localities, in the south they have proved their efficacy in enabling the apiarist to finish extracting before the hot weather goes, without the destruction of any brood whatever. They should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and with nectar in abundance to be had all around them they will work cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queen confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees will sometimes attempt to raise queen-cells above the excluder. If this happens, the queen-cells should be destroyed, as the queens which will emerge from them will not be able to pass through the excluders to get mated, and will in time develop into drone-layers. By providing the queen with plenty of empty combs she will be able to continue laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells will be at once filled up with honey.

Excluders are often condemned as being productive of overswarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences, and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers carefully watched for the production of queen-cells, very little harm can come from the use of queen-excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

THE MARKET POSITION.

Recent reports received by the New Zealand Co-operative Honey-producers' Association from their London agents indicate that the sales of New Zealand honey have greatly improved during the past two months. The information

is gratifying, and will tend to reassure beekeepers throughout the Dominion. Prior to the receipt of the 1922 crop the association was holding bulk supplies of honey to the extent of 500 tons, and the prospects of its disposal at remunerative prices were not considered to be too bright, owing principally to the arrival of Californian honey on the English market, which has been offered at lower rates than the price obtained for our product. To meet the situation shareholders in the association received instructions to dispose of as much of their crop as was possible locally, but, notwithstanding that large quantities of bulk honey were absorbed in the Dominion last season, on the arrival of the available supplies for export at the close of 1922 there was approximately 1,000 tons of honey to market. As a result of considerable propaganda work the balance of the 1921 stocks have been cleared, and it is anticipated that the whole of the 1922 shipments will be absorbed before the arrival in England of the current season's crop.

—*E. A. Earp, Senior Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

PLANTING out the winter crops will be the chief work for January. Brussels sprouts, broccoli, savoy cabbage, and kale, leeks, and celery form valuable supplies for the winter. They all require rich land well prepared. If artificial manures have to be used two parts each of superphosphate and bonedust, and one each of sulphate of potash and sulphate of ammonia, is a mixture that will suit many soils. Make a liberal dressing, and harrow or lightly dig it in.

Soak the seed-beds well the day before lifting the plants, and see that the roots are not allowed to dry out during the removal. Examine the plants carefully, rejecting those that are "blind" or of bad type. If necessary, spray or dip them in an insecticide before they are put out. Plant firmly, and water them in.

Encourage vigorous growth on asparagus and rhubarb beds. If the weather is hot and dry give them a good watering and apply a dressing or two of nitrate of soda.

Salads, peas, French beans, and carrots may still be sown in small quantities for late crops.

TOMATOES.

Trimming and tying of the plants will now require constant attention. As the bottom bunch of fruit approaches maturity the older leaves surrounding it may be removed. An application now of soluble fertilizers will be of benefit in most cases: two parts of superphosphate, one part of sulphate of potash, and one of nitrate of soda is a popular mixture. Apply it at the rate of 5 cwt. or 6 cwt. per acre (2 oz. to the square yard).

In the packing of tomatoes for the market, as in the packing of most fruit, uneven maturity is the most common defect. It is a very serious one, for when such packs are opened up in the auction-room they suffer by comparison with better ones. The size-grading of tomatoes for packing is also becoming more generally adopted.

SMALL-FRUITS.

In many raspberry-gardens the canes are small and the foliage affected with leaf-spot. A great improvement would be made if as soon as the present crop is gathered the old canes were cut out and burnt, and the new suckers thinned and sprayed with bordeaux and arsenate of lead, a second application being made, if necessary, after an interval of three weeks. A soil-dressing of soluble chemical fertilizers should also be made. In this way strong, clean canes may be secured for the next season's crop.

Most breaks of black-currant and gooseberry plants would receive great benefit from a similar spray treatment.

—*William C. Hyde, Horticulture Division.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

CALF-MANAGEMENT.

F. S. RUTHE, Leigh :—

Could you give me a preventive to stop the scouring of calves ? I would also like to know what quantity of milk should be given to each calf for each feeding ?

The Live-stock Division :—

Scouring in young calves is most commonly produced through some dietetic influence. Feeding skim-milk in a too sour condition, allowing calves to gorge themselves with cold milk in very hot weather, or using milk-pails and vessels which are not kept scrupulously clean and scalded before use, are all prolific causes of diarrhœa, through digestive disturbance. Also, the pen or place where the young calves are kept requires to be clean, and when mortality occurs it is advisable to change their location. As regards medicinal treatment, it is best to commence with a moderate dose of castor-oil—say, 2 oz. to 3 oz. After this has operated, and if scouring continues, a teaspoonful of chlorodyne, shaken up in a little milk, is useful. In the early stages the addition of lime-water to the milk is often all that is required. Regarding the milk requisite for a calf at each feeding, owing to individual requirements it is impossible to lay down any definite quantity, as some calves will consume much more milk than others of the same age. Again, the quantity will, of course, vary with the age of the calf. Speaking generally, a calf one month old will consume 4 pints of milk three times daily ; at three months old, 5 quarts of separated milk morning and evening, with the addition of the usual supplementary feed—linseed, oatmeal, &c.

DERMATITIS IN LAMBS.

"INQUIRER," Waipu :—

This year with several of my lambs I have noticed a breaking-out round the top of the hoofs. There is no discharge, but the affected part is simply raw and slightly swollen, and not accompanied by lameness. Would you please enlighten me as to this ailment and the necessary treatment ? Is it contagious ?

The Live-stock Division :—

The condition you describe is termed dermatitis or inflammation of the skin around the coronets. It is questionable whether the trouble is contagious ; it is more likely due to a common cause operating. The spell of wet weather experienced earlier in the season, by influencing the nature of the feed, probably has brought about constitutional disturbance leading to the inflammatory condition of the skin. The lesions are also occasionally seen about the mouth, and this is attributed to the sheep rubbing the mouth on the affected feet. For treatment, in the first place a change of pasture is desirable. If many lambs are affected, the quickest method is to put them through a foot-bath of lysol in water (2 per cent. solution), the bath to be filled sufficiently to cover the affected parts as the lambs go through ; or this can be carried out by immersing the feet in a bucket containing the solution. Usually two dressings at intervals of a few days are sufficient. Afterwards apply zinc-ointment to the coronets, removing any crusts or scabs which may have formed.

PRAIRIE-GRASS UNDER TARANAKI CONDITIONS.

"NEW CHUM," Oaonui :—

Prairie-grass seems to be a great winter grass, but I am told that it will not do there. The farm is on a by-road about half-way between Rahotu and the mountain. I should be glad of particulars regarding this grass when sown pure.

The Fields Division :—

Prairie-grass is a very fine winter grass in localities where it does well, but from our experience in Taranaki we could not advise you to grow it with any certainty of success in your district. If sown in a warm sheltered position fair results may be expected for a year or two, provided it is not fed too hard. The seed may be sown in the spring or early autumn at the rate of 60 lb. per acre. It should be sown broadcast and disked in, being hard to get through a drill. A better mixture would be 40 lb. prairie-grass and 10 lb. perennial rye-grass per acre.

FOUL-IN-THE-FOOT OF CATTLE.

"SUBSCRIBER," Walton :—

Please give me the cause and treatment for cows or calves with swollen hoofs which discharge pus from between the hoof and around the top in the hair.

The Live-stock Division :—

This condition is what is commonly termed "foul-in-the-foot" of cattle. The cause is bacterial, and is favoured by cattle standing in dirty, muddy places. Treatment is as follows: First pare away all broken or diseased horn from the foot, especially in the cleft; wash well with an antiseptic in water, and when dry paint in the cleft and around the top of the hoof with tincture of iodine, using a stiff brush; finally draw a piece of tow smeared with Stockholm tar into the cleft of the foot, this preventing further infection. Usually one or two applications of this treatment will be found sufficient, but in bad cases it may be necessary to first apply a bran poultice to the foot. It is essential that any muddy yards or places in which the animals stand be drained and covered with a light dressing of lime.

CUCUMBER AND TOMATO CULTURE.

H. T. P., Lower Hutt :—

What is the reason for a large proportion of the young fruit on my cucumber-vines failing to mature? They turn yellow, and I find that the majority of them are hollow. They are growing under artificial heat, watered regularly, the beds kept wet, and liquid manure applied once a week, and the house is hosed twice a day to keep the atmosphere humid. What, also, is the reason for some fruit "damping-off"? Is it advisable to apply sulphate of ammonia to a crop of tomatoes that have only had potash and super but appear to be doing all right and the fruit setting freely?

The Horticulture Division :—

Your cucumber-plants are probably being overcropped. If the tomato-plants are doing well, defer feeding till the mulch is laid, when a liquid manure composed of superphosphate, sulphate of potash, and sulphate of ammonia would probably be beneficial.

Californian Thistle.—A special order has been made by the Cook County Council declaring that Californian thistle shall not be deemed to be a noxious weed within that county. Authority for such action is given by section 2 of the Noxious Weeds Amendment Act, 1923, the text of which was printed on page 338 of last month's *Journal.*

British Market for Peas.—The following information was cabled by the High Commissioner, London, on 1st December: Continental demand is good for blue, and market considerably stronger. Japanese on passage and forward have been sold for £21 per ton. New Zealand nominally worth £17 to £20 per ton ex store; Tasmanian, £20 to £21; English small, round, hand-picked, quoted at £19 10s. to £20 10s.; and Dutch, at £23 10s. ex store. No forward business in New Zealand maple owing to poor quality of recent arrivals.

WEATHER RECORDS: NOVEMBER, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather of November was this year in striking contrast to what was experienced in the same month last year. This November will not be remembered, as it is usually regarded by the meteorologist, as the last month of spring, but as a summer month, and that of a very decided character.

The general report of the observers is that it was warm and dry in nearly all parts of the country; as a matter of fact, it was a record dry November month in many districts. Parts of Canterbury had small falls of rain on only one or two days. Maraekakaho Station, near Hastings, in Hawke's Bay, and Highfield, Waiau, Canterbury, were both exactly 91 per cent. below the mean November rainfalls.

Striking the average of the stations in the North Island shown in our table, we find they were 36 per cent. below the average; while the South Island stations were 46 per cent. below the mean. There were exceptions in both Islands: Kaitaia and Russell, in the far North, were above their respective averages for the month; and in the South Island Arthur's Pass and Okuru were also well above their usual November quantity; Nelson was also 0·30 in. above its November mean. A good fall of rain about the 16th was experienced in the Nelson and Blenheim districts, and accounted for this condition.

There were a number of changes during the month, and one or two stormy times, but generally the changes which made rain probable passed without precipitation. Dull and threatening skies were frequently experienced, with warm and humid conditions, and light northerly winds were much in evidence.

The weather in the latter part of the month may almost be described as a "heat wave," there having been some record temperatures for this time of the year. In Christchurch 90° F. was recorded; at Rakaia 91°; and in the Wairarapa over 85°. There was at times great evaporation, especially on the Canterbury Plains, from strong dry north-westerly winds.

—*D. C. Bates, Director.*

RAINFALL FOR NOVEMBER, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	4·44	5	2·04	3·27
Russell	3·48	8	1·43	1·61
Whangarei	2·90	10	1·10	3·41
Auckland	2·40	11	1·41	3·26
Hamilton	3·22	15	0·81	4·05
Kawhia	2·12	10	0·98	4·49
New Plymouth	3·43	12	0·79	4·58
Inglewood	5·93	13	1·05	8·93
Whangamomona	4·42	12	1·68	7·40
Tairua, Thames	2·72	11	1·34	3·55
Tauranga	3·17	12	0·80	3·21
Maraehako Station, Opotiki	2·76	8	0·84	2·78
Gisborne	0·72	8	0·21	3·15
Taupo	2·66	8	0·78	3·41
Napier	0·23	..	..	2·60
Maraekakaho Station, Hastings	0·14	6	0·04	2·12
Taihape	2·02	15	1·03	3·67
Masterton	0·38	4	0·18	2·87
Patea	1·30	9	0·53	3·72
Wanganui	0·83	4	0·57	3·31
Foxton	1·02	7	0·42	3·63
Wellington	0·75	8	0·25	3·47

RAINFALL FOR NOVEMBER, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
		South Island.		
	Inches.		Inches.	Inches.
Westport	2·66	13	0·74	7·08
Greymouth	4·72	15	1·10	9·46
Hokitika	5·06	13	1·14	10·68
Arthur's Pass	16·78	14	4·30	15·00
Okuru, Westland	18·14	10	3·84	12·96
Collingwood	5·90	9	2·02	7·68
Nelson	3·14	7	1·84	2·84
Spring Creek, Blenheim	1·06	6	0·58	2·41
Tophouse	2·87	13	0·66	7·07
Hanmer Springs	0·56	4	0·40	2·91
Highfield, Waiau	0·20	1	0·20	2·39
Gore Bay	0·31	5	0·20	1·98
Christchurch	0·52	2	0·49	1·84
Timaru	0·76	3	0·42	1·97
Lambrook Station, Fairlie	0·40	3	0·20	2·00
Benmore Station, Omarama	1·21	6	0·62	2·05
Oamaru	0·72	5	0·30	1·94
Queenstown	2·31	6	0·86	2·77
Clyde	0·71	6	0·23	1·36
Dunedin	1·94	10	0·72	3·27
Gore	1·27	11	0·41	3·08
Invercargill	2·72	14	0·62	4·56

FORTHCOMING AGRICULTURAL SHOWS.

Woodville A. and P. Association: Woodville, 22nd and 23rd January.
Horowhenua A. and P. Association: Levin, 30th and 31st January.
Feilding I., A., and P. Association: Feilding, 5th and 6th February.
Buller A. and P. Association: Westport, 8th and 9th February.
Clevedon A. and P. Association: Clevedon, 9th February.
Rodney Agricultural Society: Warkworth, 9th February.
Dannevirke A. and P. Association: Dannevirke, 13th and 14th February.
Te Puke Agricultural Association: Te Puke, 14th February.
Whakatane A. and P. Association: Whakatane, 20th February.
Masterton A. and P. Association: Solway, 19th and 20th February.
Katikati A. and P. Society: Katikati, 21st February.
Rotorua A. and P. Association: Rotorua, 27th February.
Opotiki A. and P. Association: Opotiki, 27th February.
Tauranga A. and P. Association: Tauranga, 28th February.
Waipu Agricultural Association: Waipu, 28th February.
Omaha and Pakiri A. and H. Society: Leigh, 1st March.
Taumarunui A. and P. Association: Taumarunui, 5th March.
Taranaki Metropolitan Agricultural Society: New Plymouth, 5th and 6th March.
Waikato Central Agricultural Association: Cambridge, 5th and 6th March.
Morrinsville A., P., and H. Society: Morrinsville, 12th March.
King Country Central A. and P. Association: Te Kuiti, 13th March.
Hawke's Bay A. and P. Society: Hastings, 18th and 19th March.
Mayfield A. and P. Association: Mayfield, 22nd March.
Methven A. and P. Association: Methven, 27th March.
Temuka and Geraldine A. and P. Association: Winchester, 3rd April.

(Agricultural and Pastoral Association secretaries are invited to supply dates and location of their shows.)

EXPORT OF APPLES, 1924 SEASON.

CONDITIONS OF GOVERNMENT GUARANTEE.

CONDITIONS for the Government guarantee of 1d. per pound net return on shipments of apples made from New Zealand during the 1924 export season are as follows :—

1. The guarantee shall be limited to approved varieties and classes of fruit packed in compliance with the requirements of the "Extra Fancy" or "Fancy" grades, and shall be restricted to a maximum of 250,000 cases.

2. The Government's liability under the guarantee shall include all packing and marketing expenses which the Department of Agriculture may deem reasonable and necessary, plus 3s. 4d. per case. No allowance to be made for cool storage unless an approved system of precooling is adopted, in which event such allowance shall not exceed 5d. per case; and, further, the insurance allowance shall not exceed that required to provide an ordinary marine-risk cover. In case of shipments to the United Kingdom no charge for selling-commission exceeding 5 per cent. will be allowed, nor will a total exceeding 1s. per case be allowed for the following overseas charges—namely, supervision, port rates, dock charges, warehousing, cartage, tolls, porterage, forwarding, and surcharges.

3. The guarantee to be limited to fruit grown and shipped (otherwise than under a f.o.b. contract) by *bona fide* fruitgrowers or fruitgrowers' co-operative societies, through channels recommended to the Minister of Agriculture by the Fruit Export Advisory Committee, and approved by him.

4. Any grower who exports any portion of his "Extra Fancy" or "Fancy" grade fruit crop outside the guarantee shall be deemed to have forfeited his right to participate in the guarantee with respect to all fruit exported during the season by him or on his behalf.

5. All fruit to qualify for the guarantee must be passed by an Inspector of the Department, and must be packed in accordance with the Export Regulations, subject to the modifications and directions set out in the appended statement entitled "Export Regulations."

6. Payment of claims under the guarantee shall be calculated on the basis of the average price received by the claimant for the whole of the "Extra Fancy" and "Fancy" grade fruit exported (otherwise than under a f.o.b. contract) on his account during the season, irrespective of markets.

7. The Government reserves to itself the right (*a*) to limit the quantity of fruit shipped to any particular port should freight rates or market conditions, &c., be deemed unsatisfactory; (*b*) to insist on all fruit being precooled prior to shipment, if deemed necessary; (*c*) to withhold the privileges of the guarantee from all fruit shipped in vessels the storage facilities of which are held by the Department to be unsatisfactory; (*d*) to withhold the privileges of the guarantee with respect to any market in connection with which the Advisory Committee are of the opinion a satisfactory f.o.b. or c.i.f. trade is or can be established.

EXPORT REGULATIONS.

With respect to the Export Regulations, the following modifications will be allowed as regards apples for the 1924 season :—

CLASSES.

The existing partial red and striped class to be separated, and a distinct striped class instituted. The colour requirements of the striped class to be 33⅓ per cent. and 20 per cent. respectively of good typical colour for "Extra Fancy" and "Fancy" grades.

COLOUR STANDARDS.

Notwithstanding the provisions of the regulations, which will not be altered in this respect until further experience has been gained, apples carrying 10 per cent. less colour with respect to "Extra Fancy" and 5 per cent. less colour with

respect to "Fancy" than is required by the regulations will be accepted during the 1924 season for export to Europe. The above reduction in colour will apply to all the classes, including the "striped" class above referred to.

GRADES OF FRUIT.

In addition to the grades "Extra Fancy" and "Fancy," apples conforming to the undermentioned "Good" grade will be approved for export for the 1924 season :—

"Good" grade: Apples of this grade shall be of not less size than 2⅜ in. (200 apples per case), excepting such special dessert varieties as may be approved by the Director of the Horticulture Division, in which case the minimum size shall not be less than 2¼ in. (225 per case). They shall be mature, sound, smooth, clean, well formed, hand-picked, true to name, and free from disease, visible bitter-pit, skin-puncture, or broken skin at stem, and other defects. Slightly blemished apples may be included in this grade, provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. Apples affected by unnatural russet may also be included in this grade, provided that no individual apple shall have more than 15 per cent. of its surface affected thereby. The individual apples of "solid red," "partial red," and "striped" varieties shall carry not less than 30 per cent., 15 per cent., and 10 per cent. respectively of good typical colour. The individual apples of yellow or green varieties shall be of good characteristic colour.

Twenty cases of any one grade shall be the minimum consignment accepted for export.

MINIMUM AND MAXIMUM SIZES OF APPLES FOR EXPORT.

The minimum and maximum sizes of apples of "Extra Fancy" and "Fancy" grades approved for export shall be those set out against each variety respectively in the list of varieties approved for export.

SPECIFICATIONS OF EXPORT APPLE-CASE.

The timber recommended for the construction of an export fruit-case is white-pine of good quality, but *Pinus insignis*, rimu, and beech timber, if well and evenly cut, will be accepted. Owing to the unsatisfactory nature of cases constructed of poplar timber, cases of this class will not be approved for export.

The inside measurements of the export bushel case shall be 10 in. by 11½ in. by 19¾ in.

Sizes of timber: The ends shall be made of boards of the following size—10 in. by 11½ in. by ¾ in.; one-piece board at each end; both end boards to be planed on the outer side. The sides shall be made of boards of the following size—10 in. by 21¼ in. by $\frac{5}{16}$ in.; one or two boards optional for each side, provided that no side board shall be less than 4½ in. in width. The tops and bottoms shall be made of boards of the following size—11 in. by 21¼ in. by $\frac{5}{16}$ in.; one or two boards optional, provided that no board used for the purpose is less than 5 in. in width. Provided that tops and bottoms may be made of boards of the following size—11 in. by 21¼ in. by $\frac{3}{16}$ in., to be used with the addition of four cleats per case, measuring 11 in. by 1 in. by $\frac{5}{16}$ in.

In the event of two-piece sides being used in the construction of the case above referred to the space between the boards shall not exceed ¼ in. In the event of two-piece tops and bottoms being used the space between such boards shall not exceed ½ in.

Nailing: Nails used to be not less than 1½ in. long, 14 gauge. Nails to be spaced not more than 3 in. apart, and the outer nails of each board to be not more than 1 in. from the edge of board.

Strapping: All cases to be strapped with a wire or steel band, such strapping to be tightly applied and to be not more than 1½ in. from end of case.

MARKING OF CASES.

A fruit-export label of new design has been approved, and its use will be essential in connection with all "Extra Fancy" and "Fancy" grade apples exported during the coming season.

A label of the design approved must be placed on each end of every case. Words and figures indicating the following only will be permissible on the label: (1) "New Zealand Apples"—"New Zealand" to be composed of letters of $1\frac{1}{4}$ in. and "Apples" of letters $\frac{3}{4}$ in. in height; (2) grower's registered number—to be of $1\frac{1}{4}$ in. type; (3) broker's registered number or shipping mark—to be of figures not less than $2\frac{1}{2}$ in. and not more than 3 in. in height; (4) name of province if desired—this must be placed immediately below the broker's number, and must be composed of letters not exceeding $\frac{3}{4}$ in. in height; (5) name of variety of apple, grade, and number of apples in the case—all of which must be of $\frac{1}{2}$ in. type. The grade will be printed on each label. The name of the variety must be placed immediately above, and the number—indicating the apples in the case—on the right of and in line with the grade-name.

A label of similar design, but produced in one colour only, must likewise be used in connection with all "Good" grade apples shipped. With the exception of the grade-name the marking of this label must in every way comply with the requirements as set out above with respect to the "Fancy" grade label.

Although a very great improvement in the branding and marking of cases was effected in 1923 over previous seasons, there is still room for further improvement in this direction. The aim should be toward uniformity in the various rubber stamps required, and colour and quality of ink used in connection with the marking of labels. In the latter connection the manager of the New Zealand Fruitgrowers' Federation has undertaken to secure and make available to shippers a good-quality ink approved for the purpose.

REGISTERED EXPORT NUMBER.

The registered number issued to all growers under the Local Market Regulations will be declared to be the grower's registered export number also. The registered number of each grower must be branded on each case of fruit exported by him.

In respect to fruit packed by a packing organization to which a registered number has been allotted, such consignments may be marked with the registered number of the packing association only, provided that each grower's fruit is shown separately on the advice-note for examination, and stacked in separate lots, so that the Inspector may have no difficulty in determining which is the particular lot under examination. For example, a line of 100 cases of Cox's Orange coming from two different growers would be submitted as follows:—

Shipping-mark.	Registered Export Brand.	Total Number of Cases.	Variety.	Grade.	Number of Cases.	Pack.
345	P607	60	Cox's Orange ..	Fancy ..	14	163
			" ..	" ..	14	175
			" ..	" ..	8	188
			" ..	" ..	12	210
			" ..	" ..	12	225
345	P607	40	Cox's Orange ..	Fancy ..	8	163
			" ..	" ..	5	175
			" ..	" ..	7	188
			" ..	" ..	9	210
			" ..	" ..	11	225

These would be stacked separately in two lots, and examined as different lines.

Should unavoidable circumstances prevent the adoption of this procedure, resulting in a line comprising a larger number of cases being submitted as one line, it must be definitely understood that the examination of same will be solely at the grower's risk, and in the event of any fruit forming a portion of the line being found to be unsatisfactory the whole line will be liable to rejection.